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The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The
Geographical Journal.

No. 1. JANUARY, 1900. Vol. XV.

ON DESERT SAND-DUNES BORDERING THE NILE DELTA.*

By VAUGHAN CORNISH, M.Sc. (Vict.), F.C.S., F.R.G.S., Associate of the Owens College.

In continuation of my investigation of sand-dunes,† I visited Egypt in the spring of 1899. Landing at Port Said on April 13, the afternoon train to Ismailia carried us past the dunes of El Ferdan, the smooth sand-slopes tawny as a lion's skin under the orange glow of a declining sun (Fig. 1). On the sky-line the profile of two successive dunes reproduced as exactly as the eye could judge the profile of blown-sand ripples (Fig. 3, *Geographical Journal*, p. 281, March, 1897). The sands near the railway were beautifully rippled by wind, crossing ripples being common. We alighted at Ismailia.

April 14.—In eight minutes' walk from the Hotel Victoria one is upon the sand-dunes which border Lake Timsah to the south of Ismailia. The dunes, I am informed, were there before the making of the Suez Canal converted the marsh into a lake. Fifty yards from the lake, 15 to 20 feet above a tilled field, the sand at 3 inches below the surface was distinctly damp at 9.50 a.m. The sun was fairly strong in a clear sky, and a breeze was blowing. I was informed that there had been no rain for weeks past. The nearly flat top of the old sand-dune, about 20 feet above the surface of the lake, exhibited some of the larger variety of ripples, such as those of which measurements are given by E. A. Floyer in the *Geographical Journal*, June, 1898. The wave-length was 86 inches, the crest nearly in the middle, the amplitude about 6 inches. A transverse section of the ridge was made. The sand at a depth of

* Read at the Royal Geographical Society, November 27, 1899.

† *Geographical Journal*, March, 1897, "On the Formation of Sand-dunes."

3 inches below the crest (and therefore 3 inches above the trough) was so compact as to stand vertically. The sand was free from any binding vegetation. The section showed strongly marked stratification. Small samples of the sand were collected, and are here recorded with reference numbers, as is done throughout this paper. Particulars of the mechanical analysis of the samples will be given in an Appendix.

FIG. 1.—MAP OF SUEZ CANAL.

Sample 1.—Taken 7 inches below crest of ripple (1 inch lower than the trough).

Sample 2.—Taken 3 inches below the crest.

Sample 3.—Coarse sand scraped off the top of the crest.

Similar ripples, measuring as much as 11 feet in wave-length, were examined in the afternoon of the same day on the desert north-west of the town.

April 15.—I accompanied my cousin, Mr. E. A. Floyer, and M. Paul Doyen (chef du Secretariat du Service des Exploitations, Compagnie du Canal de Suez) to Bir Abu Ballah. Here the margin of the dune-tract forms a rampart west and north of what was not long ago a salt marsh, but which, after draining, is now cultivated land. The steep rampart of sand, say 30 feet high, faces in various directions, differing in orientation by as much as 90°. The lower portion of the rampart is as steep as the sand can stand, but the upper portion is rounded; there is no knife-edge crest, such as is given by the back-cutting of the wind-eddy. We walked along the summit of this rampart, and it was soon apparent that its sinuosity was not due to wind. The non-cultivated tract being flat, it cannot with probability be referred to the orography of the sand-buried surface. I

suppose that the rampart conforms pretty nearly to the shape of the original marsh and of the tract of irrigated land which has replaced the marsh. The capital importance of ground-moisture in determining the formation of a dune-tract, or dune-massif, throughout the sandy districts which I visited became clearer to me towards the end of my stay. This subject, to which my attention was drawn by M. Doyen, is dealt with more fully at the end of the paper.

The surface of this dune-massif is modelled by two sets of waves, of which the crests are nearly at right angles, the ridges running from a little west of north and a little south of west respectively, these directions, and others mentioned in this paper, being compass-bearings taken with a common pocket-compass. Viewed from the cultivated land on the east, the summit of the rampart appears in waves of the familiar ripple form, the longer and flatter slope to the north, the shorter and steeper slope to the south.

Sample 4 was taken from the surface of a heap of material turned out from a drainage-canal which crosses the cultivated land. It consists mainly of quartz-looking particles, with some dust. The grains are not so well rounded as those of the dunes.

Returning to Ismailia, I went to the limit of the Casuarina plantations on the north of the town. Here a dune is in process of formation close to the road which follows the shore of Lake Timsah. It is about 140 feet broad and 8 feet high; the ends are slightly curved forward, and have no cliff. The central part of the lee slope is a cliff, but the summit of the dune is some distance to windward of the top of the cliff (compare the figure given by Captain Younghusband, on p. 99 of 'The Heart of a Continent'). *April* 16.—It will be convenient under this date to describe the observations made on several days of a dune to the north-west of Ismailia, which we came to know as "Doyen's Dune." A part of the crest forms the sky-line on the left in Fig. 25 of the paper on Sand-dunes in the *Geographical Journal*, March, 1897. The accompanying figure (Fig. 2) is a general view of this dune taken on May 13, 1899. I estimate its greatest height at about 40 feet. Its eastern end is on the summit of the rampart of sand which flanks the plantation of Abu Racan, shown in Fig. 25. At its western extremity, on the northern side, it abuts upon a large pool, which is a part of the marsh of Abu Racan. M. Doyen, at my request, had seventeen reeds put in along the top of the cliff at intervals of ten metres, commencing near the eastern, or plantation, end. This line of reeds extended from the eastern extremity of the cliff beyond the highest part of the dune, but did not reach by 70 paces the western extremity of the cliff. Beyond this, again, the dune extends as a rounded swell, until it merges in the undulating surface of the desert further west. Each day of our stay at Ismailia a northerly wind blew steadily for several hours, its strength in the afternoon being that of a stiff breeze. At that time the

haze caused by sand flying from the top of the cliff was sufficient to spoil my photograph. The photograph (Fig. 2) was taken in the early morning. The following numbers show the march of the top of the cliff before the northerly wind. The numbers in the first (left-hand) column refer to

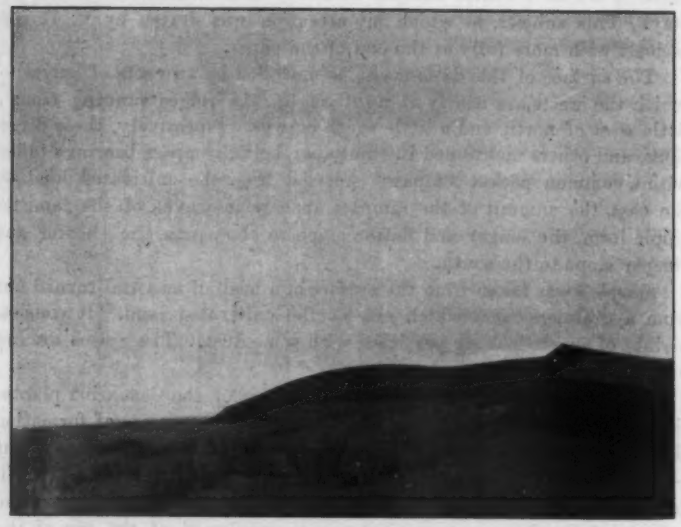


FIG. 2.—DOYEN'S DUNE, ISMAILIA.

the upright reeds, No. 1 being at the eastern, and No. 17 towards the western end, the whole distance, from 1 to 17, being 170 metres in a line following the sinuosities of the cliff-top. The highest point is near No. 12.

ADVANCE OF CLIFF-TOP OF DOYEN'S DUNE.

(Points 1, 2, . . . at intervals of 10 metres, going westward.)

	First 11·5 hours' advance.	Further advance in next 23 hours.	Further advance in next 25 hours.
Point 1	66 inches.	— inches.	— inches.
„ 2	16 „	224 „	*nil*
„ 3	22 „	68 „	*nil*
„ 4	24 „	11 „	2 „
„ 5	18·5 „	25·5 „	8 „
„ 6	19 „	18 „	1½ „
„ 7	18 „	21 „	6 „
„ 8	17 „	19·5 „	4·75 „
„ 9	16 „	19·25 „	6·5 „
„ 10	16 „	16·5 „	9 „
„ 11	11·5 „	22·75 „	8·25 „
„ 12	7·5 „	18 „	9·5 „
„ 13	7·25 „	10·5 „	14·25 „
„ 14	8 „	5·75 „	20·50 „
„ 15	9 „	9·75 „	20·25 „
„ 16	4·5 „	16 „	15 „
„ 17	4·75 „	10·25 „	22 „

The average rate of advance of the cliff-top is 0·925 inch per hour, or, excluding the one exceptional advance noted near the western extremity, 0·717 inch per hour. The results may be expressed with

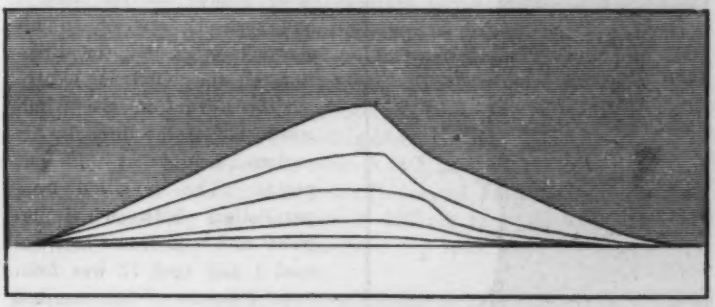


FIG. 3.—STAGES OF DUNE-FORMATION.

sufficient precision if we say that the cliff-top advanced about three-quarters inch per hour. This is the readiest means of obtaining a first notion of the rate of progression of the dune; but, as indicated by Fig. 3,

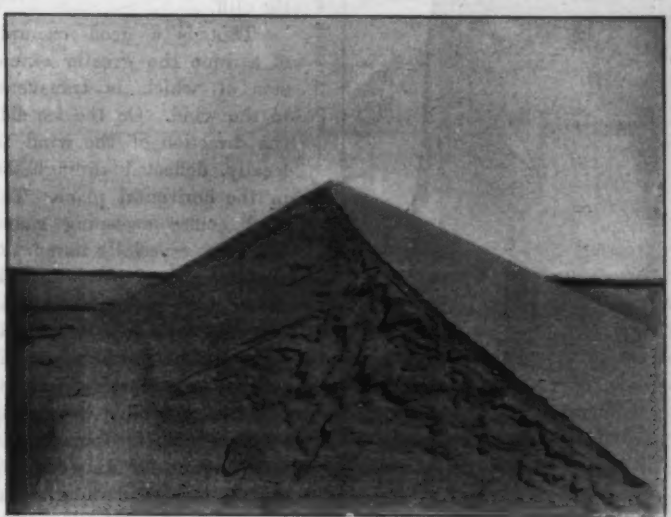


FIG. 4.—PEAK ON A DUNE (SAND SLIPPING).

the advance of the cliff-top is not necessarily at all points identical with the real progress of the dune. The direction of the cliff-front varies at different points between reed No. 1 and reed No. 12 by 45°.

FIG. 5.—TWO PARALLEL RIDGES.

The variation of direction of the ripples on the windward side of the cliff at the same points between reed 1 and reed 12 was 56°. This shows how greatly the direction of the wind is locally modified even on the windward side of the dune by its various height at different points. The deviation from parallelism between ripple-front and cliff-front between reed 1 and reed 12 was from 1 to 4 points of the compass —that is to say, from $11\frac{1}{4}°$ to 45°. This illustrates the fact that the march of the sand is not necessarily at right angles to the face of the cliff.

This is a good example of a dune the greater extension of which is transverse to the wind. On the lee side the direction of the wind is, locally, deflected through 90° in the horizontal plane. The sand comes sweeping round the ends, especially round the western end, and travels towards the middle, at the same time sweeping upwards and backwards. The activity of the wind on the lee side, and the increased capability for sorting which is conferred by the upward action of the eddying motion, is very striking. The lower part of the lee slope has a fairly hard surface, and is well rippled, the ripples facing in the reverse direction to those on the windward slope of the dune. The upper part of the

lee slope of the more developed and middle part of the dune is the well-known straight cliff which has a soft, unrippled, slipping, plane surface. It has been customary to ascribe this slipping cliff to the pushing of sand-grains over the crest by the forward action of the wind and their downward rolling. This explanation implies that the cliff is constantly refaced by sand-grains thus driven forward from the surface of the windward slope. What I saw on this and other dunes during my stay in Egypt convinced me that this notion is incorrect. The cliff is due to undercutting by the backward-acting eddy. Were the sand coherent, an overhanging cornice would be formed, as I have seen happen during an easterly gale on a sandhill at Poole Haven. I have watched the same process when lying under a bank of drifting snow on the hills above Innsbruck (January, 1898). The loose dry sand, however, slips, so that

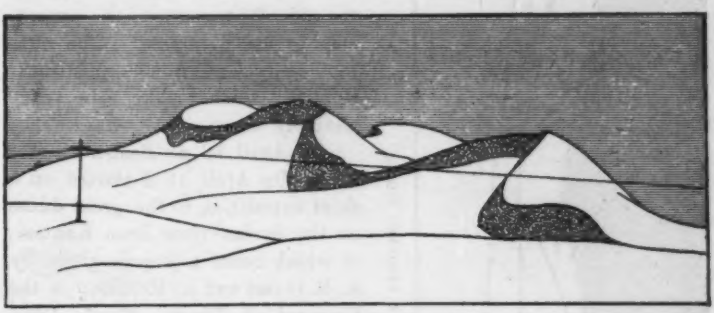


FIG. 6.—A CURIOUS TRIPLET.

the spraying sand-wave has not the cusped form, but presents the curious anomaly of a straight line interpolated between curves moulded by the wind.

Fig. 3 is from a drawing made at the western end of Doyen's Dune, somewhat generalized to represent what appeared to be the aspect of the sand-dune profiles at successive stages of development. It is not precisely a diagram, for the intent was to represent the appearance of the slopes, which is generally steeper than reality. I hope in the future to replace this figure by careful measurements; meanwhile the following description of the probable course of development of the dune profile must suffice. The case considered is that in which the eddy on the lee has not cut down to hard rock. At first both windward and lee slope are very gentle; the highest point is near the middle. The summit probably moves to the leeward of the middle point, the lee slope certainly becomes steeper. A slipping cliff is formed on the upper part of the lee slope when the eddy has gained sufficient strength. The top of the cliff is worked back towards the summit; the windward slope meanwhile

FIG. 7.—FOUR PARALLEL RIDGES.

becoming steeper. Finally, windward and lee slope become of nearly equal average steepness, and the top of the cliff coincides with the summit of the dune.

On April 17 I went in a steam-launch of the Canal Company to those dunes on the south-western shore of Lake Timsah, which form so beautiful a feature in the view from the landing-pier at Ismailia. Fig. 4 shows a lee slope taken at the moment of slipping. The form of the peak almost produces, with the aid of perspective, the appearance of the pyramids.* The cliff-top is composed of constituent ripples, which make the edge minutely wavy.

On April 18 no field-work was done. On April 19 I started on a short expedition to the great dunes on the Syrian route from Kantara, of which route a map is given by A. R. Guest and A. McKillop in the *Geographical Journal*, March, 1899, p. 283. I left Kantara at 9.40 a.m. with four attendants, camels, tent, etc. At 2.10 p.m. we reached the palm trees of El Ookha, and resumed the march at 4.15 p.m., over round-backed sandhills somewhat similar in shape to rolling chalk downs. Later on we came to the fully developed dunes. We camped at Bir Nisf at 6.30 p.m. On April 20 we started at 5.45 a.m., still following the telegraph line eastwards. I sketched the views which

* If the form of the pyramids was really suggested by a feature of the landscape, I think the peak on a dune ridge is a more likely origin than the conical hills left by erosion in the rocky desert.

I photographed, which was fortunate, as most of the photographs were over-exposed. The forms can be represented by an outline drawing, for there is no visible detail. The lines represent the sky-line, the top of the cliff, and the summits of the ridges. Fig. 5 is looking north at 6 a.m. Fig. 6 looking north at 6.50 a.m. The shading is the only alteration made in the sketches after leaving the spot. At this early hour the scenery is bizarre and strange, the contrast of light and shadow being quite lunar in its intensity. This is not to be wondered at, considering

FIG. 8.—ABU RAMLE.

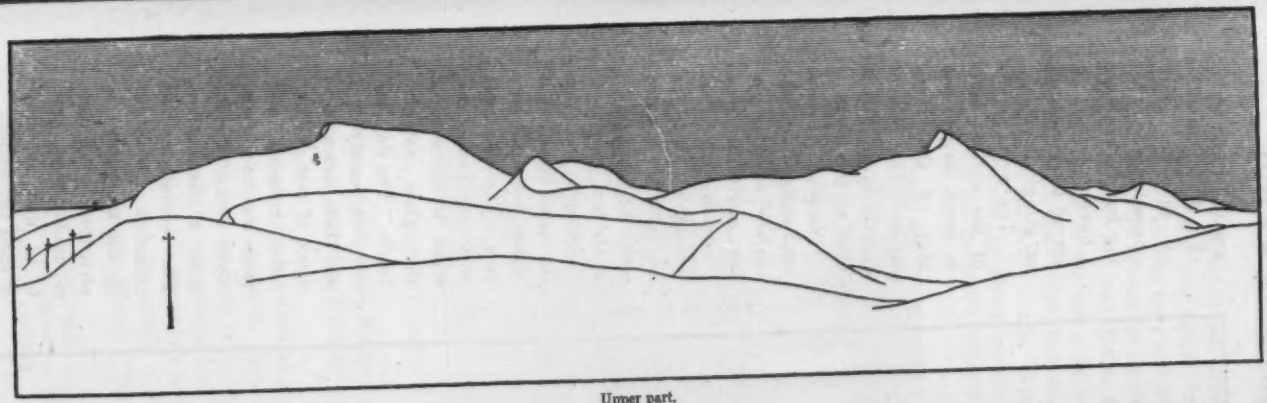
that the *grêtes* are only one sand-grain broad. Moreover, the absence of detail on the surfaces of pure blown sand, the steep slopes and bold forms, together with great clearness of definition and a deathlike stillness, combine to produce an impression of being surrounded by lofty mountains. It requires a distinct effort of reasoning to dispel the illusion of being surrounded by mountains of 3000 metres instead of hills of 300 feet. Unfortunately, photographs do not reproduce the illusion. Fig. 7 is of four parallel ridges of sandhills on the north; the whole distance from the first to the last ridge may be 3 miles, but the distances are difficult to judge. The ridges run approximately east and west. The south is at present the lee slope, but in most of the large dunes here the crest seems to be turned back and twisted by the present northerly

winds, the main windward slope being on the westerly side. There were no vertical or overhanging cliffs. These, I expect, are formed by violent winds quickly stripping the loose surface, and then carving the compacted sand below. Fig. 8 is a sketch of Abu Ramle (the Father of Sand), the furthest point reached. We reached Bir Nisf again at 9.30 a.m., and retraced our steps towards Ookha. Fig. 9 is looking south at 10.15 a.m., a typical undulating dune country, recalling snow surfaces. Presumably there is a great depth of sand below the troughs of these gentle undulations. On the road back it seemed to me that beneath the visible swells there was a longer undulation which I was tempted to compare with the long heave of the ocean invisible in presence of shorter steep waves, but which in absence of information

FIG. 9.—ABU RAMLE.

one must admit to possibly follow the configuration of the *bottom* of the dune tract. Fig. 10 gives a sketch taken north of the route on the afternoon of the 19th (above), and a second which was, in forgetfulness, taken from nearly the same spot at 10.55 a.m. on this day, the 20th (below). Their reproduction shows how far my sketches are consistent. The distance between the telegraph-posts is 80 metres. Fig. 11 is a sketch taken at 11.45 a.m., looking back towards Kantara; the foreground yellow sand in rounded undulations, the distance a plain, first yellow with brown dots, afterwards brown with yellow dots, as the proportion of clean brown sand diminishes. The dots are bushes. We arrived at Ookha at 12.30. Fig. 12 is from a photograph under the palm trees there, showing the rampart of the plateau of sand on the south of the damp spot called the Wells.

Samples 9 and 10 were collected on this slope. I noticed, on examining the sand on the spot with a lens, that the larger grains were better rounded than the small ones, which suggests that the former have been longer exposed to the action of wind, that the latter



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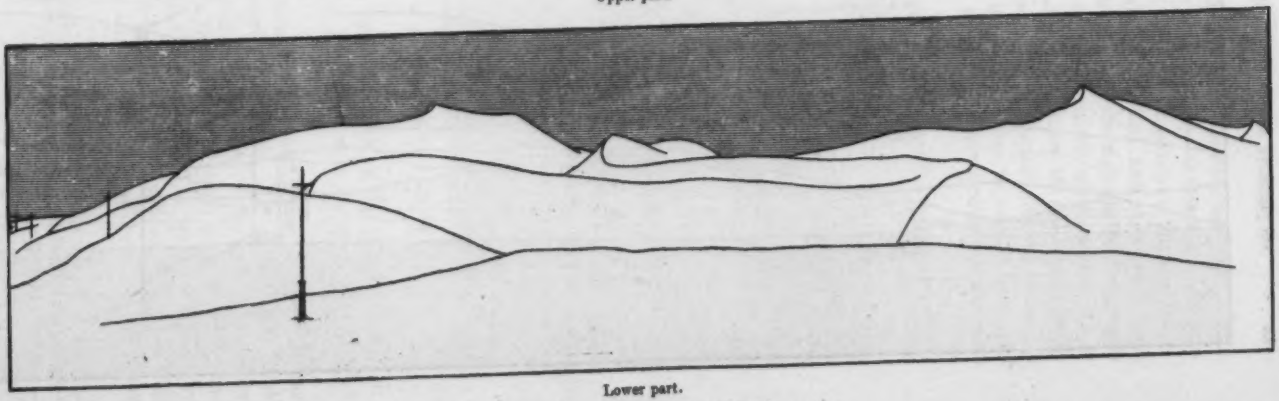


Lower part.

FIG. 10.—CONCORDANT SKETCHES.

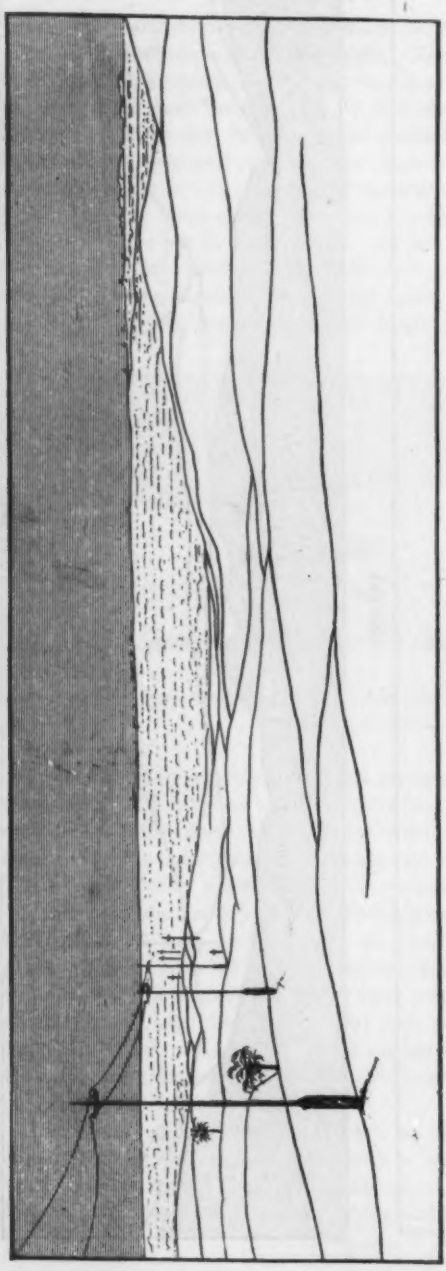


FIG. 11.—LOOKING BACK TO KANTARA.

are, in fact, chips, and that the comminution of the sand-grains proceeds not by grinding but by breakage. I have repeatedly observed the same thing on shingle beaches.

The average size of the surface layer is much larger than that of the lower layers. The present (northerly) winds blow up this slope.

Sample 11 is coarse sand scraped from the surface on the plateau above this slope.

Sample 12 is an average sample of the top layer of a rounded swell beyond (south) of the last.

Sample 13, from the same spot, but 3 inches below the surface. This sand was very compact, and stuck to the sides of the glass sample-bottle. The day had been extremely hot, and there was no evidence of rain having fallen recently, and there was no surface-water at the "Wells," some 40 feet below. The seeping up and retention of moisture by the sand-dunes is undoubtedly of considerable importance to an understanding of their properties.

Fig. 13 is a sketch taken from this spot, looking eastward. The great dune is called Abu Assab; it is said to be 500 feet high. In this extensive view all was pure yellow blown sand, except a few shrubs.

April 21.—We set out for Kantara at 5.10 a.m., and at 6 a.m. I made a second sketch (Fig. 14) of Abu Assab. On the right is the long south and west slope, on the left a part of the northerly slope, which is now the windward side. The dark shadow is the steep lee face produced by the present northerly winds. Apparently the main outlines of the hill are determined by westerly winds, but the top is turned back and twisted by the present northerly wind.* I subsequently saw the main

FIG. 12.—RAMPART OF SAND, CLOSE TO A "WELL."

outlines of this dune distinctly from the deck of the R.M.S. *Austral* on the canal, between Kantara and Port Said, at a distance of 17 statute miles.

Sample 14 was taken at 8 a.m. from a mound near a bush. It has the brown tint which characterizes the plain east of Kantara. The level of the sand here is obviously being lowered. The erosion is mainly due to the winds coming from a little south of west, as is shown by the direction of the ridges left behind the bushes. The marks of erosion by rain are also frequently visible here, whereas among the dunes they were strikingly absent. The general lowering of level in this place

* I suggest that the violent winds from a little south of west do most of the *transport of sand*, and the ordinary northerly winds most of the *modelling of the surface* in this and neighbouring localities.

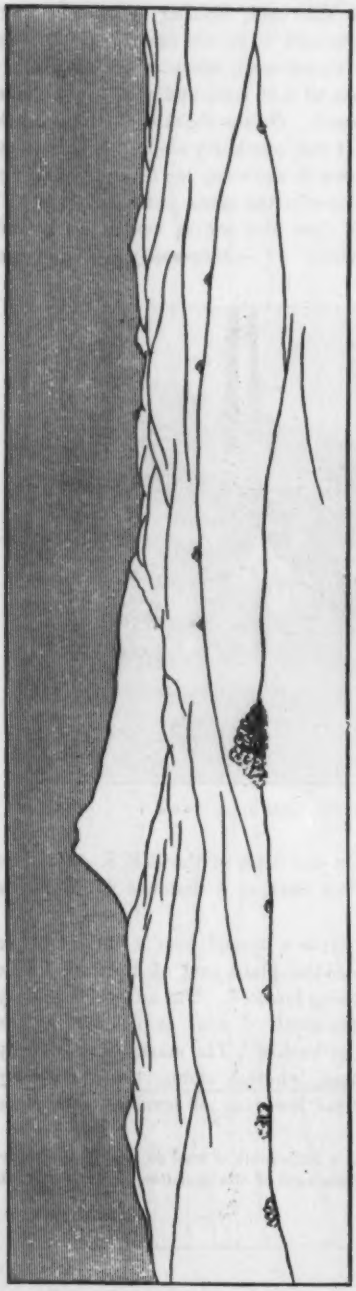


FIG. 13.—UNDULATING SANDS, ABU ASSAB IN THE DISTANCE.

where bushes abound, and the accumulation in the near neighbourhood where such obstructions are few, is an instructive example of the insufficiency of the "casual obstruction" theory to explain the origin of dunes. I arrived at Kantara at 8.45 a.m. Returning to Ismailia by train, I was struck by the contrast between the fresh yellow sand-surface west of the canal, and the old, brown, vegetable-stained sand on the east. Presumably the cutting of the canal is largely responsible for this difference. A large sand-dredger was at work near by.

On April 22 I accompanied MM. Tiffnay and Doyen on an inspection of the plantations on the west side of the canal, designed to arrest the drifting sand. The positions where the sand-drift is most troublesome are, of course, not where dunes occur, but where, in the absence of any retarding influence, the sand travels freely in a thin film over the plain. At Toussoum the casuarina trees had been planted two years. They are watered with a little sweet water, and appear perfectly healthy. In the plantations, which are close to the canal, are also mimosa, acacia, tamarisk, and other trees and shrubs, but the casuarina is the mainstay. It grows rapidly, attaining, at Ismailia, a height of nearly 60 feet in twenty-five years. It is said to be capable of

drawing its supply of water from a considerable depth. The foliage is feathery, such as cheats the wind of its force. The tree will not stand frost. Leaving Toussoum in the steam-launch, I observed that there was a 2-foot cliff on the west bank of the canal, except where reeds (*A. gigantea*) have been planted. These afford an almost perfect protection against the wash of the steamship waves. Their roots are kept moistened by sweet water from a little sweet-water channel on the bank. Landing at Serapeum, we visited another plantation of casuarina trees which have grown from 50 cm. to 3 metres in two and a half years. They are at present supplied with sweet water, but it is thought that it will not be necessary to continue this for more than a year or two, as there is water at 3 metres, which by that time their roots should reach. Here, also, reeds (*A. dona*) are grown for use as temporary barriers against the drifting sand. Altogether we visited 3½ kilometres of plantation.

FIG. 14.—ABU ASSAB.

On April 23 I left for Cairo by the railway. Subsequently (May 12) I did the same journey in the reverse direction. Between Ismailia and Abu Hammad (Fig. 15) the influence of ground moisture in causing the formation of dunes is strikingly illustrated. South of the Wady Toumilat is visible a plain dotted with scrub, and bordered on the south by mountains. No dunes were seen here except just along the south border of the moist valley, where they form a conspicuous feature. To the north of the Wady the ground rises somewhat rapidly. Here there is a stony plain, scored by rain-erosion, without dunes. I am informed that sand blows freely about this plain. Whether the formation of a dune-massif by ground moisture is wholly owing to increased mechanical coherence of sand, or whether it is assisted by electrical discharge, I do not at present know. That electrification plays some part in sand-transport is likely enough, considering the mobility of electrified sand. At Tel-el-Kebir, on the north of the line, may be seen the plantation undertaken by the Government for experiments in acclimatization of plants in the desert.

April 24 to 27 was spent in Cairo, and on April 28 I went to Helwan, where the principal rock is limestone.

On April 29 I went up the Wady Hof near Helwan, where both wind-erosion and water-erosion are finely shown. Fig. 16 shows wind-cutting of the cliff, and a talus of the residual fragments. The portion of cliff shown in the photograph is about 60 feet high.

Sample 16 is a specimen of the sand which occurs very scantily in the Wady.

FIG. 15.—MAP OF THE DELTA.

April 29.—I rode eastward from Helwan. Where no principal Wady has yet been cut the rain-water wanders very freely in search of the lowest level, as is easily seen by the mud-channels. There is a good deal of salt about, which probably increases the erosive effect of rain by causing the soil to cake. This will prevent the rain sinking in, thus favouring its accumulation in channels, where, however, the salts no longer constitute a sufficient binding material. Probably the length of drought is almost as important as the quantity of rainfall in determining

the amount of water-erosion, for it is the drought which hinders vegetation, and otherwise assists the rain when it comes.

On May 2 I left Helwan on a visit to Mr. Floyer's plantations on the western edge of the delta north of Menashi. The train left Cairo at 2.30 p.m., and stopped to set me down at 3.40, where a trolley was in waiting, which conveyed me to the rest-house. Bounding the view on the west are furrowed hill-slopes, composed, I understand, of a coarse gravel or conglomerate, with sand in the troughs between the ridges, nestling against the southern flanks of the latter. The ridges are nearly bare of sand, and brown in colour. The general effect reminds one of snow clinging to the shady side of the valleys

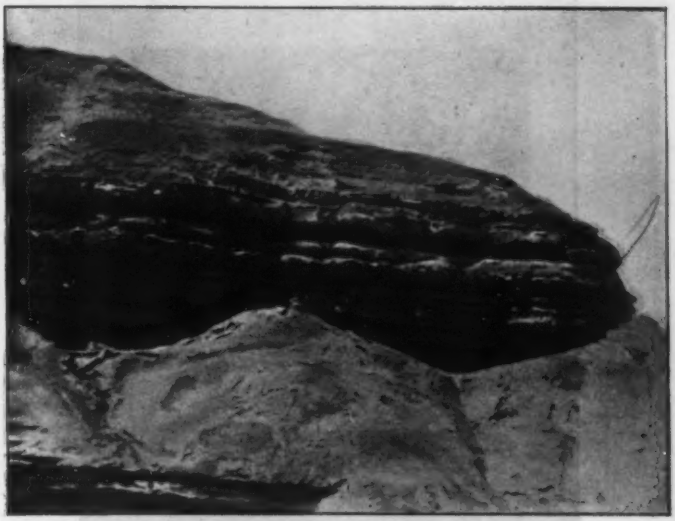


FIG. 16.—WIND-ERODED CLIFF, AND TALUS, WADY HOF.

on the spurs of a mountain-side. Mr. Floyer's efforts are directed to reclaiming a flat strip (about 40 kilometres long by 3 or 4 wide) between these hills and the westernmost branch of the Nile. The desert sands have not only driven back cultivation from a great part of this strip, but in places have deeply buried the fields to the east of this branch of the Nile. The Nurseries are between the railway and the stream, where the plants can be readily watered. In one of these the casuarina were being re-potted. Both here and in other nurseries where the trees have been planted out, their general healthiness is remarkable; it is almost impossible to find one drooping. The men employed in tending them are peasants from the neighbouring village, with no special training, but they seem to have an inherent or

inherited aptitude for the work, which they do with a will, and with pride in the growth of individual trees. One casuarina of a year old, having shot up to the unusual height of 2 metres, the men have named "Kitchener Pacha." The others of this nursery of the same age are rather less than 1 metre; all were grown from seed in practically pure sand. The lines of trees are as regular and straight as in any English nursery. Near by I saw a casuarina which had been for six months standing in a bucket of water, yet appeared perfectly healthy, which

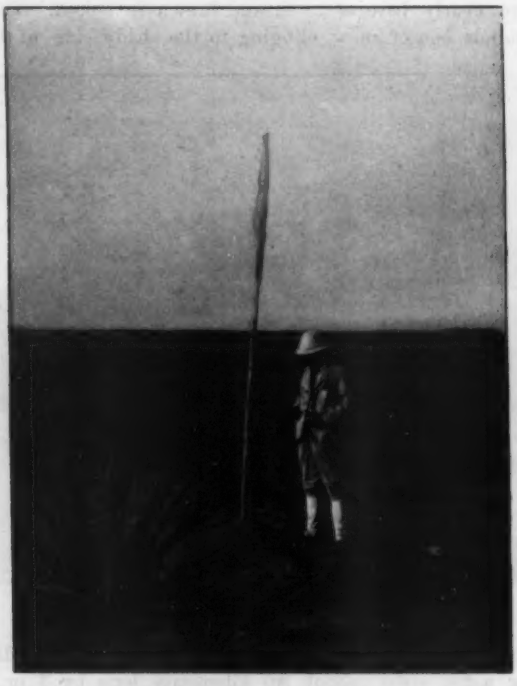


FIG. 17.—AGAVE RIGIDA SISALANA.

shows how well suited the tree is to a district subject to periodic inundation. Ground-nuts planted at foot of the casuarina serve to fix nitrogen, to shade the ground, and as an index of proper watering. They are also worth something for oil. Near by, the casuarina were being planted away from the canal, entering on their proper work in the desert itself. The method of planting is as follows. An iron cylinder, 14 cm. diameter and 60 cm. long, is sunk in the sand. The workman scoops out the sand (they can burrow in the material with surprising facility) and fills the cylinder with a good light mould.

The cylinder is then removed, and the tree is planted in the mould, so that it has nourishment provided until the roots have gone down 60 cm., when the damp sand is reached. A man can plant sixty casuarina per diem in this way. The wage is one franc a day. Fig. 17 shows a fine plant of *Agave Rigida Sisalana* further out in the desert. Being more distinguished than his fellows, the men have called him "Sheikh-as-Saadat." The figure in the photograph is that of Mr. Floyer. The "Sheikh" has been two years in the desert without attention, and has nine well-grown suckers. Other plants near by have eight, nine, twelve, and thirteen suckers. They have flourished exceedingly without watering, and Mr. Floyer expects that they will rapidly cover the neighbouring desert. The fibre, I am told, is worth £34 a

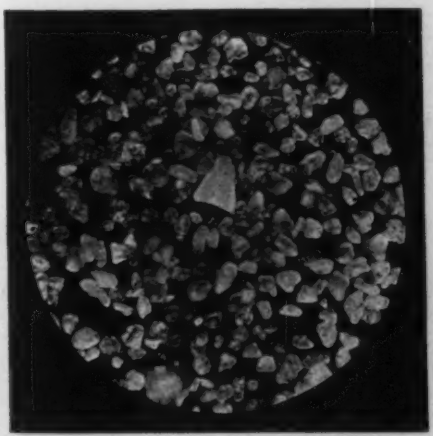


FIG. 18.—SAND-GRAINS, LEE OF ARTIFICIAL DUNE (MAGNIFIED).

ton, and the manufacture is extremely simple. The casuarina also has considerable value in a country where even firewood is imported to the value, I am told, of £30,000 per annum.

On May 3 Mr. Floyer and I left the rest-house (north of Menashi) at 6 a.m., and boarded the train for Terieh. On the right hand I could see islands of blown sand among the cultivated lands of the delta. After Katatbeh we passed through a belt of land which is still cultivated, showing what can be done about here. An old ruin near by supplies a nitrogenous manure. There is a bank of sand on the west of the line at the railway-station, Terieh, produced by a reed fence placed to check the sand-drift. Fig. 18 is a microphotograph of a portion of *sample* 21, taken on the lee side, and near the summit of this artificial dune. The want of uniformity of size of grains should be

noticed. The artificial dune was round-topped; there was no very active eddy here to perfect the work of sorting.

At Terieh I noticed that black earth is brought up in well-making from below the sand. Below the black earth, Mr. Floyer informs me, there is coarse sand. These facts point to former cultivation. Fig. 19 is a photograph (looking north) of a cemetery wall 6 feet high, at Terieh, banked up by drifting sand on both sides. The top of the wall keeps free of sand, which is usual, but worthy of remark.

Sample 22 is from the eastern side of the wall.

Sample 23 is from the western side.

FIG. 19.—CEMETERY, TERIEH.

Sample 24 is from the sandy plain, taken between the cemetery and the village.

After returning by train to the rest-house near Menashi, I took *sample* 25 from the top of a small dune, where grass had prevented rippling. I returned the same day to Helwan.

On May 4, half a mile north of the town of Helwan, between the railway and the quarries, I collected *sample* 26 by scraping from the surface of the ground within the space of a few square inches. I noted that there appeared to be round about a sufficiency of hard sand-sized grains to form dunes, if only they had formed a sufficiently large *proportion* of the material in which they occur. Some scrapings from the top layer of the crest of ripples appeared to contain quartz grains, with much fine, soft stuff. Taking a handful of the pulverulent ground,

I threw it into the air: stones dropped down straight to the ground, and a copious cloud of dust, best seen by its shadow, floated away in the northerly breeze. The range of size of the material is too great, and the proportion of sand-sized particles too small, for the ready formation of dunes. Their absence is not due to lack of wind-action, as is well illustrated by the wind-cut tables hard by, one of which (height about 4 feet 6 inches) is shown in Fig. 20. The action of the wind upon the rocks here produces stones and dust; sand-sized particles can also be found. Is the almost complete absence of sand-dunes connected with the too-rapid formation of dust from stones, and the necessary consequence that sand-sized particles are kept in a hopeless minority?

FIG. 20.—WIND-FORMED TABLE, HELWAN.

On May 7 I crossed the Nile to Mariette's House, in order to see the country near the pyramids of Sakhara. Here (west of the Nile) are rolling hills of hard gravel, similar to those which border the plain west of the country from Menashi to Terieh. Lying in the more sheltered spots is a scattering of golden sand, which gives the country a tint very different from that of the desert on the east of the Nile, near Helwan. In this connection I quote the following passage from a letter by Mr. Floyer (March 9, 1899), in which he says: "[Riding down the east bank, between Halfa and Assuan], it was easy to see the hills on the west bank covered with golden sand pouring into the Nile. There is on the east none of this golden sand at all."

In crossing the Nile this day I found on the west side a sandy

foreland exposed by the subsiding waters of the river, which were then near their lowest level, on which, within the space of a few hundred acres, I saw a greater variety of forms of dunes than I met with during the rest of my tour. They were small—the highest not more than 4 feet—but perfect dunes; by no possibility to be confused with ripples. Their daily observation throughout a fall and rise of the Nile would have been an ideal exercise in the study of sand-dunes. Even the three visits I was able to pay to the sandy foreland yielded results which I believe to be of considerable interest.

Fig. 21 (Plate I.) is looking up-wind (N.N.E.). The steep lee cliffs stand out strongly. It will be noticed that the dunes are in transverse ridges, but that these ridges undulate. The view looking down-wind, the lee cliffs not being visible, showed no such striking contrast; indeed, the photograph is so faint that I have not had it reproduced. The sand is Nile sand (*sample* 27), fine, glittering, micaceous, splintery; quite unlike the rounded quartz sand of the samples I collected in the desert. During most of the time I spent on the foreland the sand was flying briskly. Fig. 22 (Plate I.) shows longitudinal ridges piled up against lee cliffs. The structure is readily understood when one watches the sand sweeping round from both ends of the cliff. I suppose it to be similar to a structure described by Dr. Blandford:* "From the north-east corner of most of the high hills near Bálmir a long ridge of sand runs out, evidently developed by the wind under the lee of the hill." It is not difficult to see that if the wind should continue sweeping out the sand from the depressions between the higher portions of the transverse ridges shown in the photograph, and depositing a part of it thus behind the highest part of the cliff, the longitudinal ridge thus formed may play an important part in a conversion of transverse into longitudinal dunes. I first saw these dunes in the morning; on my return in the afternoon the wind had increased, and there was a haze of flying sand 20 or 30 feet high over the foreland. In many places, where in the morning there had been loose sand, the wind had now cut down to the damp, compact floor, and the ripples appeared distinctly larger. Fig. 23 (Plate I.) shows a small dune, about 2 feet high, produced by a reed fence. The crest of the cliff is parallel to the fence, although, as shown by the surface-markings on the sand, the fence is not at right angles to the wind. Fig. 24 (Plate II.) is a perfect example of one of those singular structures known as fuljes in Arabia.† This was only 30 yards from the river, off which the wind was blowing. The photograph was taken looking down-wind at 5.15 p.m. The circular floor of compact material is about 12 feet in diameter. On the left there is a double ridge. I was able to watch the process by which this was being formed, sand coming to it from the left

* "On the Physical Geography of the Great Indian Desert," *Journ. Asiatic Soc. of Bengal*, vol. 45 (1876), p. 98.

† *Geographical Journal*, March, 1897: "Sand-dunes."

PLATE I.

FIG. 21. Train of Dunes, looking upwind.

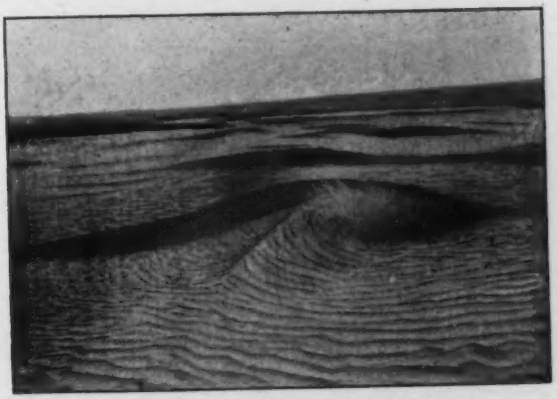


FIG. 22. Longitudinal Ridge developed under the Lee Cliff.

FIG. 23. Dune formed by Reed Fence.

and from the right, the latter sweeping in swirls across the floor of the fulj. The compact floor was somewhat eroded by the wind, showing a sort of erosion-rippling. I stuck a reed cane in the sand at the summit of the cliff and at the leeward edge of the floor in order to be able to observe the progress of the fulj.

Next day, May 8, I returned to the foreland, where I landed at 8.15. The cliff-summit of the fulj had advanced 18½ inches in the fifteen hours, *i.e.* at an average rate of 1¼ inch per hour. [In the next forty-eight hours it advanced 29½ inches, or 0·66 $\left(i.e.\ \frac{6\ H}{10}\right)$ inch per hour, *i.e.* for the whole sixty-three hours average rate = 0·76, say three-quarters of an inch per hour.] The wind was now not nearly so strong as last night, and the troughs on the lee side of the cliffs were for the most part scattered over with loose sand. On the previous day I had been struck with the small ratio $\frac{\text{length}}{\text{height}}$ which was in places presented by several succeeding dunes. I had measured short series presenting ratios $\frac{L}{H}$ 11 and 13 respectively. As the eye became accustomed to the maze of forms, I began to suspect, however, that there was some compensating arrangement, such as would make the dunes flatter than ripples * along one profile and steeper along a neighbouring profile of the same ridge. I therefore marked out a line accurately up and down wind, and measured heights and lengths along this line with a tape as exactly as I was able to do without assistance. This set of measurements commences about 40 yards from the Nile, and proceeds down-wind to the end of the group of dunes, hard ground succeeding.

Length (L), inches.	Amplitude (H), inches.	Length (L), inches.	Amplitude (H), inches.
396	35·5	Bt. forward 5100	Bt. forward 325
624	32	420	7
432	32	360	9
648	18·5	216	17
360	14	360	16
300	26·5	348	11
264	6	360	7
252	27	180	6·5
426	32·5	192	21·5
330	37	414	35
486	35	450	14
348	12	378	11
234	17		
Cd. forward 5100	Cd. forward 325·0	Total L 8778	Total H 480·0

$$\frac{\text{Total L}}{\text{Total H}} = 18{\cdot}3$$

* The usual ratio $\frac{\text{length}}{\text{height}}$ for ripples is about 18 (vide *Geographical Journal*, March 1897, and June, 1898).

The individual ratios $\frac{L}{H}$ vary from 8·92 to 60·00. (The measurements of May 10, with assistance and better appliances, gave a concordant result. See *post.*)

On the higher portions of the foreland, to leeward and further from the river, barchans (or medanos) occur, of which Fig. 25 (Plate II.) is an example. The photograph is taken looking in a westerly direction, at right angles to the wind. The height is about 3 feet. The darker parts of the foreground are the eroded compact floor, with erosion-rippling. Round the edges of the barchan is scattered yellow quartz sand, a residuum after winnowing away of much of the micaceous river sand. I also found shallow lenticular patches of sand with the sections parallel to, and at right angles to, the wind, both symmetrical, which appeared to be the embryo of the barchan, when the latter is formed by deposition of sand upon a hard floor. It is, however, not difficult to imagine that in some cases barchans may be residual forms. Thus, if the wind continued to blow away the sand from the spot shown in Fig. 24 (Plate II.), and, the Nile having reached its lowest point, very little more sand were supplied, the floor of the fulj might be left as a bare space half enclosed by the horns of a barchan, the windward side of the fulj being the lee cliff of the barchan.

Sample 28 was taken on the lee side of the foreland from the lee of the crests of the ripples. In this part of the tract the yellow quartz sand is conspicuous. Presumably this part of the foreland has been longer exposed to the action of the wind, and the quartz grain has been purged from the micaceous "chaff."

I may here remark that small dunes, such as those with which we are now dealing, indicate what the forms of big dunes would be if winds did not vary. My next visit to the foreland was on May 10. I had obtained the loan of accurate measuring appliances, and I was fortunate in the kind co-operation of a practised surveyor, Mr. G. T. Ogilvie. Landing at 8 a.m., with a man to assist in putting in the stakes, etc., we laid down an accurate 200-metre line in the up-and-down-wind direction, not far from my line of the 8th instant. The amplitudes of twenty-three ridges were carefully measured along this line, their aggregate amplitude being 1081 cms., and the sum of the twenty-three wave-lengths 19,340 cms. Therefore—

$$\frac{\text{Total wave length}}{\text{Total amplitude}} = 17{\cdot}9$$

This differs from my previous result by 2·2 per cent. These results for true dunes (though small ones) differ very little from those previously obtained for ripples. I had measured on the Dorset coast twelve sets of ripples of blown sand from 0·06 to 0·34 inch H,

PLATE II.

FIG. 24. A Fulj.

FIG. 25. A Barchan.

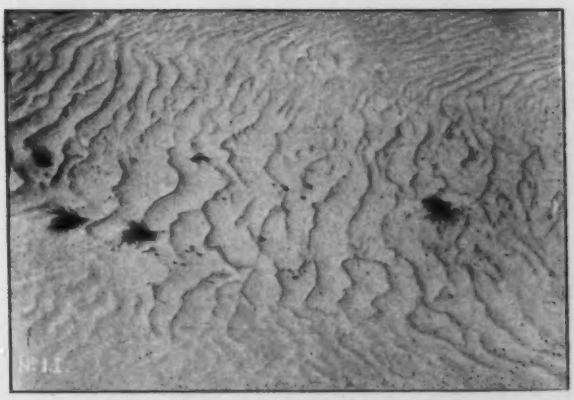


FIG. 27. Ripples, in the trough leeward of a Dune.

which gave an average $\frac{L}{H} = 18{\cdot}4$. These were for the most part measurements of one or two individual ripples. E. A. Floyer had measured six of the largest kind of ripples on the El Arish route, and obtained $\frac{L}{H} = 17{\cdot}7$, with H varying from 6 to 10·6 inches. For my later measurements of ripples, see p. 27. I now require a set of measurements across a train of big dunes, in order to see if the ratio of about 18 still holds. It is a singular circumstance that $\frac{L}{H} = 17$; 18 is a usual value for the average of a train of waves during a storm in the open sea.

FIG. 26.—ABU RACAN, ISMAILIA.

The undulating crests of the transverse dune ridges observed on the foreland contrast with the almost absolutely uniform ridges of ordinary accumulation-ripples of blown sand. The growth in amplitude of the former had probably been accompanied by a lowering of the mean level. The trough was now on a hard floor. The progress of the ridges was relatively slow (I have observed ripples moving thirty-five times as fast, or 0·44 inch per *minute*), and any slight inequality would under these circumstances, and with a scanty supply of sand from windward, tend to increase, so as to give a markedly serrated crest.*

* Cf. *Geographical Journal*, June, 1898, "Sea Beaches and Sandbanks," § 13 (*c*).

The remarkable point about the measurements made on the foreland is that they appear to indicate an exact compensation between the diminution of amplitude thus brought about at certain points of a transverse ridge and the increase of amplitude at the intermediate positions.

On May 12 I returned to Ismailia, and on May 13, at 7 a.m., was at Abu Racan, the plantation to the north of the town already referred to. The trees were planted with the purpose of retarding the progress of the sand-drift and of the dune already formed near the marsh, so that the photograph is not, as might be supposed, the picture of a failure. Indeed, the healthiness of the trees when buried so many feet in sand is very satisfactory and encouraging. It is hoped that the casuarina

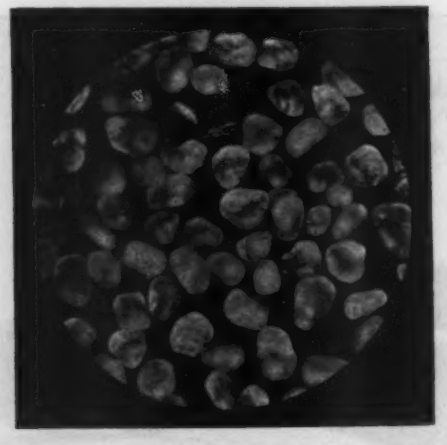


FIG. 28.—SAND-GRAINS FROM LEE CLIFF OF NATURAL DUNE (MAGNIFIED).

will continue healthy as long as the top of the tree is free of sand and the roots are down to the moisture. Fig. 26 shows how the rampart of sand faces this way and that, following the boundary of the former marsh and the present plantation. Fig. 27 (Plate II.) is taken from a position upon, and near the western end of, the cliff-top of Doyen's Dune, looking, from an elevation of about 18 feet, downwards at the large erosion ripples on the leeward in the trough, beyond the lee face of the dune. These ripples have a position as if due to west wind, but in point of fact a north wind comes to them from the west side, being deflected by the dune. The light is from the east, that is from the reader's left hand. The greatest wave-length, according to my recollection, was about 5 feet. The irregular wave-fronts contrast strongly with the straight wave-fronts in places where the wind flows parallel to the surface, and where sand-supply is plentiful. The crests, also,

are nearly in the middle, instead of being close to the lee end. On the other hand, it is precisely in positions such as that of the ripples now photographed that ripples grow to large size. At a spot near the foot of the cliff, at the top of the eddy slope and near the west end of the cliff, one could clearly see the difference in character of ripples according as the wind strikes up or follows the slope. The great amount of sand which had been winnowed on the spot photographed was indicated by the extreme coarseness of the sand on the crests of these ripples. When I have made a mechanical analysis giving the percentage of the different sizes of sand in such places, the ratios between the total quantity of sand winnowed, the "chaff" blown away, and the heavy stuff left, should be calculable. The immense amount of sorting at this spot is presumably due to the upward suction of the air here, due to its position to leeward, and near the end of, the foot of the dune cliff. It is easily understood that the difference between the resistance of large and of small sand-grains is greater for lifting than for rolling.

Not far from the spot photographed, also on the lee of, but further from, the dune, I selected for measurement a long train of moderately large ripples. As well as I could judge, the air here (during the northerly winds) could have a very slight upward tendency, but there was no wind at the time.

MEASUREMENT OF A TRAIN OF 36 RIPPLES* NEAR DOYEN'S DUNE, ISMAILIA.
(In eighths of an inch.)

Wave-length, L.	Amplitude, H.	Wave-length, L.	Amplitude, H.
176	8	Bt. forward 3186	Bt. forward 201·5
156	11	236	11
86	6·5	310	15
220	10·5	256	15
166	11	169	11
176	12·5	204	12
92	8	192	16
104	6	283	18
187	16 5	54	1
151	10·5	298	15
231	12·5	209	9
168	11	146	3
193	10	143	10·5
192	11·5	280	16
187	14	115	8·5
102	6·5	219	12·5
148	11	364	22
260	13	222	16
191	11·5	130	10·5
Cd. forward 3186	Cd. forward 201·5	Total L 7016	Total H 423·5

$$\frac{\text{Total L.}}{\text{Total H.}} = 16{\cdot}57.$$

* *I.e.* Thirty-seven ridges, comprising thirty-six waves.

The individual ripples are distributed pretty uniformly between $\frac{L}{H} = 11{\cdot}3$, and $\frac{L}{H} = 23{\cdot}2$, but with two, exceptionally flat, of $\frac{L}{H} = 48{\cdot}7$ and 54 respectively.

Sample 29 was collected by pushing the bottle into the unrippled face of the lee cliff near the centre of the dune. The material looks wonderfully uniform. Fig. 28 is a microphotograph of a portion of the sample. The magnification is the same as in Fig. 18 of the less rounded and less uniform sand of the dune at Terieh (one artificially produced by the erection of a fence of reeds).

On May 14 I was rowed across Lake Timsah, and visited some small scattered sandhills occurring within a mile or two of the eastern shore. There was a good deal of vegetation upon them, but the sand was being swept away from around the bushes. Our ship arrived in the small hours of the 15th, and we left Ismailia for England. In conclusion I must add that I was much assisted in making the best use of my time while in Egypt by my cousin, Mr. E. A. Floyer. I have also to thank M. Paul Doyen and officers of the Suez Canal Company and of the coastguard for their kindness to us during our stay at Ismailia. I have also to thank Mr. G. T. Ogilvie for helping me in measurements made during some hours of choking sand-drift. Whilst in Cairo I received valuable information from members of the Survey as to dunes west of the Nile, but this has not been drawn upon for the present paper.

Note on the Effect of Ground Moisture in Formation of an Accumulation of Blown Sand, or "Dune Massif."

Monsieur Courbis, in a memoir entitled 'Les dunes et les eaux souterraines du Sahara,'* contends that ground-moisture is the pre-existing condition which determines the localities in which blown sand accumulates in the desert. M. G. Rolland† had previously specified the causes which in his opinion determine these accumulations, the "Chaînes de dunes," or "grandes dunes," the orientation of which, as he points out, have nothing in common with that of the elementary dunes, or sand-waves, into which their surface is moulded by the wind. Of these causes the prime is, in his opinion, the orography of the country acting by modification of the transporting power of the wind, particularly where "les accidents topographiques permettent au vent une expansion qui diminue sa vitesse." Replying to M. Courbis in *C. R. de Soc. de Geogr.* (Paris), 1890, p. 158, he admits that moisture is a cause of stability of dunes when formed. "Je suis d'accord avec M. Courbis quand il voit là une des raisons pour lesquelles les grandes dunes restent stationnaires. Avec lui, je dirai que les sables entassés acquièrent en s'humectant une pesanteur plus grande et une certaine cohésion, plus de stabilité et plus de force de resistance contre le vent. J'ajouterai qu'a par faveur de cette humidité, il se développe au pied des grandes dunes une vegétation spontanée, que l'on voit constamment tapisseur leur lisière et qui contribue encore davantage à les fixer. Mais ec sont là des phénomènes posterieurs au dépôt des grandes dunes, et, dans la

* *C. R. de Soc. de Géographie* (Paris), 1890.

† *Bull. de la Soc. Geol. de France*, 3e serie, t. x. 1881.

généralité des cas, ce n'est pas humidité *pre-existante* du sol qui a motivé leur dépôt. Cela est vrai parfois, mais ce n'est qu'un cas particulier, et non une loi général. Un fait au contraire vraiment général au Sahara est que la surface du sol est très séche; même dans les dépressions artésiennes, la nappe ascendante supérieure ne se trouve le plus souvent qu'a 2 ou 3 mètres au-dessous de la surface, s'il fallait que le sol fût humide pour que les dunes puissent s'y déposer, il y aurait relativement bien peu de dunes au Sahara."

The dunes described by me in the present paper are situated in flat country, and the extent of the marshes and damp places precludes the notion of the moisture being entirely or mainly due to what has been collected after the formation of the dunes. In seeking the most accessible dunes I was led round the border of the delta (the dunes south of Wady Toumilat and those on the route to El Arish border on former branches of the Nile). This fact alone would have been of itself suggestive, even if I had not repeatedly, at Lake Timsah, Bir Abu Ballah, Abu Racan, Lake Mahsama, and elsewhere, found the dunes fringing lakes and marshes. On the "sandy foreland" of the Nile I was actually able to watch the largest of the dunes there being formed up against a backwater near the lee side of the foreland. Thus, although pre-existing ground-moisture may be merely an occasional cause of accumulation of blown sand in the Sahara south of Algiers (as to which M. G. Rolland speaks with probably greater weight of experience than any one else), it is in my opinion the principal factor in the districts which were visited by me in April and May, 1899.

Next, as to the effect of moisture in "fixing" dunes. The compactness and immobility of the slightly damp sand is very striking, and has been commented upon by M. Courbis and M. Roland. Nevertheless, the wind dries the surface, and I watched these dunes "smoking" freely every afternoon when the heat had raised the wind. I even measured a fairly rapid advance of the crest of Doyen's dune, three-quarters of an inch per hour. Mr. Floyer has more than once raised the question with me, "Do these dunes *really* move?" I expect that the doubt expressed in this question is justified, and that in many cases the dunes he and I have visited, separately or in company, are *stationary waves*, the structure persisting in the same place on account neither of complete immobility of material, nor of magnitude too great for winds to transport perceptibly, but of permanence of the inducing cause.

I proceed to examine more closely into the mode of accumulation of blown sand (formation of a dune massif) in a desert through the operation of a cause, such as ground-moisture, which does not modify the wind. I remark in passing that we have here at first a heterogeneous accumulation of sands, since there are no eddies such as are caused by rigid angular bodies. Wind cannot erode below a thick covering of sand; therefore there can be no great accumulation of wind-formed sand at the place of erosion. Again, since winds are not absolutely constant in direction, the sand derived from a given area of, *e.g.*, Nubian sandstone are spread by the winds over a larger area. Thus, erosion of a sandstone rock to a depth of 1 cm. will result in the spreading of a film of sand over the neighbouring desert, the thickness of which will be only a fraction of a millimetre. This sheet of sand is shifted hither and thither by the winds. The annual resultant motion of each sand-grain may be small, but the total length of its highly irregular annual path is great.

The amount of sand which annually passes over any spot in the middle of the desert depends, not upon the small resultant motion of a sand-grain, but upon the whole length of its irregular path. I emphasize this deduction because, for me, it removes a difficulty in understanding the great rapidity with which sand-dunes sometimes appear to be formed.

Suppose the wind to blow in a desert for two hours per diem during a hundred days of the year with sufficient force to shift sand pretty freely. If one watches an individual sand-grain when a moderate wind is blowing, one sees that its motion is generally intermittent, with relatively long pauses, but that when it moves at all it generally moves rapidly, I think at a rate of more than 1 kilometre per hour. Let us take the speed to be only 0·5 kilometre per hour, and the time of actual motion of any one sand-grain one-tenth (*i.e.* 0·2 hour per diem) of that during which the wind is blowing with the stipulated force. We then have for the total annual course of each individual sand-grain

$$0{\cdot}5 \times 0{\cdot}2 \times 100 \times 100{,}000 = 1{,}000{,}000 \text{ cms.}$$

If the sand-grains have an average diameter of 0·05 cm., a continuous single layer would contain 400 per sq. cms., supposing them spherical. If we take one-fiftieth of this number, 8 grains per sq. cm., as a fair scattering of such sands over a desert, then such a scattering is equivalent to a continuous sheet of sand of 0·001 cm. thickness. Take an area of 1 sq. cm. in the midst of the desert. The area of the sand-sheet which will annually pass over that sq. cm. will be 1,000,000 sq. cm. If the whole of this sand were accumulated there it would have a thickness of

$$1{,}000{,}000 \times 0{\cdot}001 = 1000 \text{ cms.},$$

or 10 metres. Practically the travel of sand is not completely stopped. I think a diminution of one-half in the mobility of the sand is not an excessive estimate of the effect produced in places where dunes grow, *e.g.* where there is ground-moisture. Perhaps other observers may not concur in this estimate, so let us take the case of a proportional retardation of only one-fifth. Even this would produce a dune 2 metres high in one year.

After the reading of the paper, the following discussion took place:—

The PRESIDENT: I had hoped that Mr. Blandford might have been here to illustrate Mr. Vaughan Cornish's paper from his knowledge of the deserts of India, and that Sir Thomas Holdich might have been here to illustrate the paper from his knowledge of the sand-dunes of Baluchistan. I believe we have the pleasure of welcoming Mr. Hogarth; perhaps he will say something on the subject connected with his knowledge of the sand-dunes in Asia Minor.

Mr. D. G. HOGARTH: I have made no scientific observations, but have been over a good deal of Mr. Cornish's ground between Kantara and El Arish, and the only contribution I can make is by asking him one or two questions.

I have no doubt he has noticed that there is a great deal of difference in the motion of sand at different times under what would appear to be a wind of much the same strength; sometimes it appears to be moving under a light wind most, at other times under a strong wind. Has he anything to add to the theory that electric action has something to do with the pace at which sand moves? Electrified sand is supposed to move much more quickly than ordinary sand.

The only other thing I wish to ask him, as I didn't hear the discussion three years ago on fuljes, although I have always been interested in them, is how the wind comes to create pits on such an enormous scale as are found in the northern parts of Arabia, some 200 feet in depth; and whether it is true that these are excavated, and if the ground which is left bare is really the under-lying stratum below the thick covering of sand. I should like to ask him, also, whether he ascribes the formation of pits on that enormous scale to the gradual action of the wind, or the unusual action of such great storms as leave traces on the desert that are not effaced in a century.

One of the most curious things in a desert is to find one's self surrounded by

every feature of an ordinary landscape—deep valleys and deep water-cuttings, and yet no rain falls during the many years one may be in the country. The ordinary rain or wind appears absolutely unable to create such phenomena as fuljes, and it occurs to me that these pits on a very large scale may be due to a great storm, and that the ordinary wind, while unable to create them, is able to keep them open.

Dr. J. W. Gregory: I am afraid that this is not a paper likely to lead to much discussion, as, illustrated by Mr. Cornish's photographs and his abundant array of fact, his explanations seem conclusive. I should like to express the pleasure with which I have listened to his interesting and suggestive paper. The subject is one which has been rather neglected by English geologists, though it is of considerable practical importance, and when studied with the careful and accurate methods of Mr. Cornish, is found to yield very interesting theoretical conclusions. I should like to ask him whether he has made many observations on the permanence in position of dunes of which the whole material is moving forward. I was struck with a case close by Lamu, where dunes 150 feet high have gradually moved inland and buried the site of the old Portuguese town of Sheila; the sand was moving at a fairly rapid rate, while the dune was moving infinitely more slowly. I had not time to make many observations in different conditions of wind, but it seemed to me that the eddy under the lee side of the dune carried the sand at right angles to the direction of the dune down into the estuary, where the tide swept it out to sea; again it was piled up on the beach and gradually swept up the windward slope over and over again. The motion of the sand was rapid compared with that of the dune, which was very slow. I hope we shall have further contributions from Mr. Cornish, especially if he could study in the same way the dune-formation in regions of volcanic sands, in which the material is of higher specific gravity, and especially, unless he has already studied it, the formation of snow dunes, as we may call snowdrifts, where we have the same series of phenomena with a material of lighter specific gravity. I should like to ask whether the same ratio of height to length holds in such cases.

Prof. Bertrand: I should like to point out how very much I have been struck with the accuracy of the observations of Mr. Cornish. It has been my good fortune to see high sand-dunes in the province of Tarapaca, about 1000 feet high, where the railway passes through them. Further south there are sands creeping along the hills more than 3000 feet above the level of the sea. These should make, I think, an interesting subject for those who may wish to make observations there. I think the engineers of the nitrate railways have made some observations, because the sand interferes with the track. I have also seen fuljes, such as have been thrown on the screen, and I can endorse the accuracy of the observations as to the different aspects of the dunes at different times of the day. They have struck me in just the same way. I think, if the materials are the same, it may be expected that the same phenomena will be repeated in different quarters of the Earth.

The President: Before asking Mr. Cornish to answer the questions that have been put to him during the discussion, I will add some questions which have been asked in letters from two geologists.

Mr. Teall says: "Some of our triassic and permian sandstones are composed of beautifully rounded quartz grains, exactly like those so common in desert sands. I wonder if Vaughan Cornish, with his intimate knowledge of the structures of sand-dunes, could prove that they represent fossil deserts? It has been suspected, but never proved."

Mr. Clement Reid says: "I do not feel at all clear as to the exact part played by moisture in the sand; for with a strong dry wind the sand seems to travel freely on a tidal flat, unless it is so wet as to give a noticeable reflection. Hollows between

our sand-dunes seem always to be sufficiently moist for the growth of moss. Inland dunes are scarce in this country, except in west Norfolk. I have only come across one low ridge in this neighbourhood (Fordingbridge), though I should imagine that much of the material in the soil, and the matrix of the clay with flints, have been moved by the wind, especially during the Glacial period."

Mr. VAUGHAN CORNISH: With regard to the mobility of sand under a wind at one time, and its apparent immobility under wind of like force at another time. The only explanation which I have at present is that to which Mr. Hogarth has referred, viz. that electricity has something to do with it. As soon as I came back from Egypt, I started working on the subject, and found myself getting involved in an atmosphere of atmospheric electricity, and if I had gone on thus I should never have got this paper written, at least in any reasonable time, and so I put this aside for the present.

As I said in my paper, in many cases the dunes appear to be stationary waves, the structure persisting in the same place owing, not to complete immobility of material, but to the permanence of the inducing cause. That is practically what Dr. Gregory has said just now, in a less jejune manner.

With regard to the forms of snowdrift, I have some notions on the subject, and have made a few observations, but I have not hitherto been very fortunate in opportunities of observation. I did get some at Innsbruck, and lay out under the drifts to see what was going on. I hope soon to add to these observations.

The PRESIDENT: Mr. Vaughan Cornish has devoted several years to the study of a branch of physical geography which has hitherto received little attention. He has done this in a most workmanlike way, first on the beaches in England, and now he gives us an interesting paper on the results of his studies in Egypt. I have no doubt that the object of his study will become a regular branch of our science, when a larger number of observations has been accumulated. I believe, although Mr. Vaughan Cornish has found examples of almost every form of sand-dune in Egypt, that he will think it necessary to visit other countries. I hope to hear of his having studied the sand-dunes of Holland and the Landes of France, and the sands of the deserts of India and Central Asia, and the medanos of South America, both on the east and west coasts. I hope he will visit the arctic regions and examine the *sastrugi*, described by Baron Wrangel. I am assuming that Mr. Vaughan Cornish will have to carry his investigations into almost every continent, for as he is the only one amongst us who is devoting his attention to this subject of kumatology, I am convinced that he will have to trust to his own efforts. Eventually others will follow in his track, because it is a fascinating branch of study, and we shall have established as one of the branches of our science, kumatology, or the study of waves. Mr. Cornish does not confine his attention to the sand, but it extends to any material met with in waves.

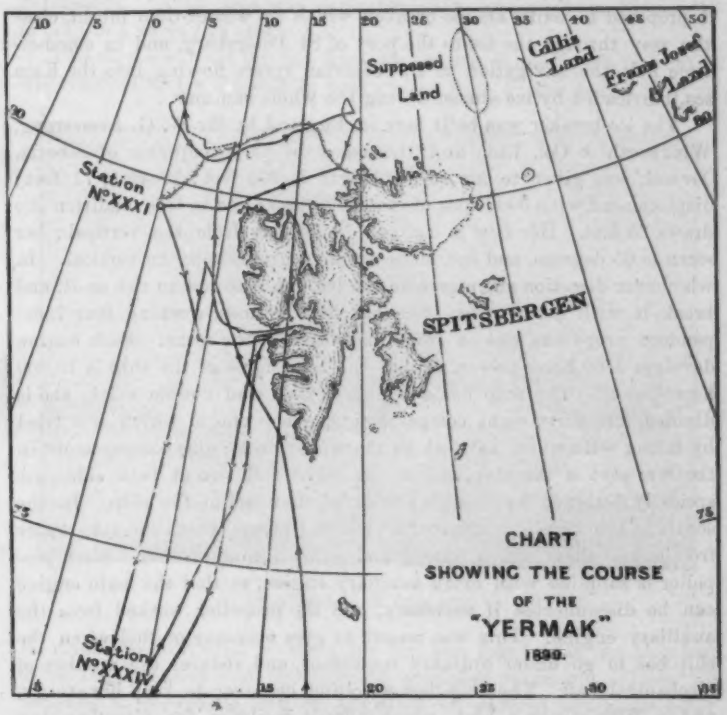
The paper has been extremely interesting, and beautifully illustrated, and I am sure you will wish me to convey to him a unanimous vote of thanks.

THE "YERMAK" ICE-BREAKER.

By Vice-Admiral MAKAROFF, of the Russian Imperial Navy.

THE old way of travelling in the polar regions was by means of dogs and sledges. Dr. Nansen proposed to travel with the ship, making her so strong as to resist the pressure of the polar ice. He succeeded in this perfectly well; his ship could stand the attacks of the polar ice,

and his defensive tactics proved to be very efficient. Just at the time when Dr. Nansen proposed to build his *Fram*, I had the idea of adopting offensive tactics against the polar ice. I was engaged at that time with my service, and did not then see my way to disclose my ideas, but I made some preliminary preparations. I wrote to Dr. Nansen a letter in which I stated that I was entirely of his opinion, that he would be carried by the currents somewhere in the direction he imagined, and advised him that help should be sent for him to Franz Josef Land. My letter to him and his answer were duly published in the Russian



newspapers and in geographical publications. I thought it quite possible that he would not complete his voyage in three years; I also thought that, if in four years nothing was heard of him, people would be anxious to send help, and that would be a good pretext for collecting money.

In my opinion the best way to penetrate into the arctic regions is by means of a powerful ice-breaker. Certainly I did not wish to mention in my letter to Dr. Nansen that I would go and help him, because, being on government service, I could not dispose of myself. But I

asked him in my letter if he had any intention of leaving any trace of his voyage. He replied that he intended to put on every island that he might discover, a pole with a small Norwegian flag on it, and under that pole a letter with information about the voyage of his ship. Fortunately for Dr. Nansen, the current carried him on very well, and on my return from the Pacific station, I was happy to learn that he and his *Fram* had safely returned home. Of course that deprived me of my excuse for collecting the necessary money for building a large ice-breaker, but I found another motive, this time purely commercial. I proposed to build an ice-breaker which in winter-time might clear the way through the ice to the port of St. Petersburg, and in summer-time help the navigation to the Siberian rivers flowing into the Kara sea, barricaded by ice almost during the whole summer.

The ice-breaker was built here in England by Sir W. G. Armstrong, Whitworth & Co., Ltd., and the name of the conqueror of Siberia, *Yermak*, was given to her. Her length is 305 feet; breadth, 71 feet; displacement with 3000 tons of coal, 8000 tons; and in this condition she draws 25 feet. Her bow is inclined 70 degrees from the vertical; her stern is 65 degrees, and her sides are 20 degrees from the vertical. In whichever direction she moves in the ice, she is bound to rise on it, and break it with her weight. She has four engines, working four independent propellers, one in front and three at the stern. Each engine develops 2500 horse-power, so that the total force of the ship is 10,000 horse-power. The ship has a double bottom and double sides; she is divided into forty-eight compartments, every one of which was tried by filling with water as high as the upper deck; one compartment in the fore part of the ship, one at the stern, and two at both sides, are specially designed for changing the trim and heel of the ship. In the centre of the *Yermak* is situated a powerful pump, which can take water from any of these compartments and pump into the other. Each propeller is supplied with extra auxiliary engine, so that the main engine can be disconnected if necessary, and the propeller worked from the auxiliary engine. This was meant to give economy of fuel when the ship has to go under ordinary conditions, and reduces the number of mechanical staff. The ship has a rolling chamber to keep her steady, and a lifting crow's nest, which affords facilities for directing her through the ice.

I selected a very distinguished officer, Captain Wasilieff, to command the *Yermak* during the experiments, but I was on board myself on every important occasion.

Her maiden voyage was from Newcastle to St. Petersburg. We entered the ice at the meridian of Revel, and had to force our way through 160 miles of ice. It never occurred to any one that the ship would go to Cronstadt in winter-time, and our entering Cronstadt harbour caused quite a sensation.

The limits of this paper does not allow me to give details of our performance in the Baltic. Soon after our arrival in Cronstadt, a telegram was received that thirteen steamers were caught in the ice near Revel, and some of them were in danger. The *Yermak* went at once to Revel, and opened the way for these and other steamers, the total being forty-one, partly blocked in the ice, and partly waiting in Revel harbour and other ports for several weeks. This work done, the *Yermak* proceeded again to Cronstadt, and helped forty steamers going to St. Petersburg. After this was done, the ship proceeded to Newcastle to take in a supply of coal.

The ship was built for the Kara sea, where is one year's ice, but it was resolved to try the ship in heavy polar ice. In the month of June

ICE-HUMMOCKS 22 FEET HIGH.

we made our first trial in the polar ice, and found that the ship had to be strengthened and the forward propeller taken out. Then we returned to Newcastle, and on August 6 we entered again the polar ice. This time we were in the ice two weeks, covering during that period 230 miles in 87 hours.

We entered the ice to the north-west of Spitsbergen, on August 6 at noon, and in eight hours made, in the ice, about 30 miles to the north, going always in a zigzag route. Then we stopped almost for three days, examining the ice and the ship itself. During that period we were drifted west-south-west at the rate of 10 miles a day, the wind being north. Then we made again 10 miles to the north, and stopped for a day, and in eleven hours made 30 miles to the north again, the wind always blowing from a northerly direction. At this last place we met

an ice-floe 14 feet thick; stopped to examine it for a day, and as the pressure of the ice increased every hour considerably, without evident reason for this, I thought that we were too much to west, and that this was not the route for the ice-breaker. After considering the matter, I came to the conclusion that in this locality pressure of the ice should be almost constant; the direction of the movement of the ice to the north of Spitsbergen is west-south-west, while on the western part of it, it is south-west by south. There ought to be something that compels the whole body of ice to change its direction almost suddenly as much as three points. I presume that this change is due to the position of the Greenland coast, which stops the westerly progress of the ice. Owing to this a heavy pressure is accumulated on the north-eastern side of Greenland, which interferes with the drift of the ice of that locality to the south. The ice remains there for many years, growing in thickness. Is it not due to this that Nares met on the coast of Greenland heavy ice, to which he has given the name palæocrystic? Certainly this is only my conjecture, but it looks at present rather probable. If it is so, this locality is not a place through which one would advance fairly ahead, even with the powerful ice-breaker.

The pressure of ice was so considerable, and the ice so heavy, that it took me four hours to make two miles to the south. After this the ice was less thick, and we went at our usual rate, making 2½ miles an hour; later on the ice became still easier, which allowed us to go more quickly. After we covered about 60 miles we found open water, followed the boundary of it, and entered the ice again to the north of Seven Islands. In this place we had much of the hummocky ice, but that did not stop the progress of the ship.

On August 14 the weather was very clear, no clouds on the horizon, and the air very transparent. We saw to the east of us a land which is not marked on the map. We did not see that land directly. We saw it only by the refraction of the air, but we saw it distinctly from six o'clock in the evening to eleven o'clock the next morning, and took the bearings of it. It could not be Franz Josef land, the nearest part of which was at that time at a distance of 260 miles from us. Neither was it Gillies Land, which was at the distance of 160 miles. We believe we saw undiscovered land, and if we estimate the distance to be 100 miles, that land should be no less than 60 miles long.

On August 16 we directed our course to the south, and we saw four complete table-shaped icebergs from 40 to 60 feet high, and many *débris* of icebergs; one of them was completely covered with moraines. We picked up some stones from it. A little piece of metal was found between the stones, and there are signs of metal in the other stones. It has not yet been examined by any geologist, so that I cannot say much about their nature. Neither can I state from what land they come. Maybe they come from the land which we supposed we had seen.

During the whole voyage we had an opportunity of studying the nature of the polar ice, the *Yermak*, with her powerful cranes and winches, offering a very efficient means for this. Our usual way was to cut a piece of ice, or to find one of a suitable size, and to lift it on deck. The pieces which were found in the water were liable to melt, although the water had a temperature of 29°·3 Fahr. This melting affected the superficial part of the block of ice, and the interior of it was as strong as might be. A block of ice being brought on deck, holes were drilled into it at different depths, and the thermometer introduced. Generally the temperature of the ice at that late season, at the surface, is not far from

GOING THROUGH EASY ICE.

freezing-point, and in the lower strata it corresponds to the temperature of sea-water.

On one occasion we had a good chance of taking the temperature of an ice-floe, 14 feet thick; a piece of it, broken by the *Yermak*, was found floating on its side. We found that the temperature inside of it was 28°·2 Fahr., *i.e.* 0·5° below freezing-point of sea-water. I am not sure whether it shows that such thick blocks do not lose entirely, during the summer, their excess of cold received in winter.

After the temperature of the block of ice was taken, we used to cut at different depths oblong pieces of a certain size, and by submerging them in water, study the specific gravity of the ice. Experiments were made with twenty-six samples, and they have shown that the floating

part of the ice is within the limits of 6·5 per cent. to 16·4 per cent., while the average is 12·0 per cent.

After experiments on the floating of the ice, oblong pieces were subjected to the trial of breaking. The strongest ice was found to be glacier ice, which required 180 lbs. to break the oblongs. The weakest ice proved to be that from the floe, 14 feet thick, and required 63 lbs. to break it; the average of the other ice shows that 110 lbs. are required to break the same oblong. After this we melted the ice from different depths of the floe, and we tested the melting-point. It proved to be very near to the freezing-point of fresh water.

The exterior part of the ice in water is spongy, with canals and holes in it; it looks from the top like lace. The ice of this spongy part has the lowest melting-point visible, from 31°·3 to 30°·6. We subjected the sea-ice to the influence of a current of salt water, 29°·8 Fahr., and found that ice melts in that temperature very easily. It is rather remarkable that ice melts in water the temperature of which is more than two degrees below its melting temperature.

After the melting-point of the ice was determined, we measured the specific gravity of the liquefied ice; it was proved that this water contained generally very little salt indeed. Surface ice gave almost fresh water, but the ice at the bottom of the floe contained a little more salt, salinity varying from 0·01 to 0·69. The latter high salinity is obtained from the liquid ice of the spongy part of the floe.

Direct measurement of the ice-floes has shown that the ice-ridges have generally the height of 10 to 14 feet. It is not unusual to meet an ice-ridge 16 feet high. One separate ice-ridge was 22 feet high, while on one occasion we saw a detached piece projecting something about 6 fathoms. We did not reach it, and consequently could not measure it, so that this last figure is estimated by eye.

There is no difficulty in measuring the superficial part of the ice, but it is not so easy to obtain a proper knowledge of the depth to which the ice-ridges extend below the water-line. The direct boring of the ice gives good figures. We had an ordinary boring-machine, but that did not answer the purpose well enough, because the progress of boring was rather slow. Then we arranged a steam-jet, which melted a hole in the ice, and answered the purpose admirably; but unfortunately we were short of pipes, and could not reach the lowest part of the ridges. The direct boring showed the thickness of ice and water layers, or spaces in the direct vertical line. These are the figures:

First boring—		Second boring—	
12 feet ice.		21 feet ice.	
2 „ water.		2 „ water.	
3 „ ice.		3 „ ice.	
2 „ water.		—	
4 „ ice.		Total ...	26 feet.
—			
Total ...	23 feet.		

Then we tried to pass under the ice-ridges a float with Thomson's sounding-tube attached to it. We put the float on one side of the ice-floe, and passed the rope around it to the other side; a little weight was generally attached at one fathom distance from the float. When the rope sank properly, we pulled it to the other side of the floe; sometimes all this manœuvre was done with the boat, and sometimes with the ship itself, her three propellers giving facility for such complicated manœuvre. The float passed under the chain of ridges, but of course it did not get to the lowest part, which might project somewhere. Often the sounding-tube has shown 4 to 5 fathoms' depth, but some-

HUMMOCKY FLOE.

times it has shown 7 fathoms. Separate pieces may project below to the depth of 8 or 9 fathoms, so that the ice-floe may touch the ground at that depth, but probably will not properly settle itself until the depth of 5 or 6 fathoms is reached.

Hydrological observations consisted in determining the specific gravity of water at different depths. Below I give the specific gravity and temperature of water at two stations, one being on a parallel of the north part of Spitsbergen, another on the parallel of North Cape.

Station No. 31, August 20. 79° 41' N., 40° 58' E.			Station No. 34, August 23. 73° 22' N., 16° 20' E.		
Depth, fathoms.	Temperature, Fahrenheit.	S. $\frac{17{\cdot}5}{17{\cdot}5}$	Depth, fathoms.	Temperature, Fahrenheit.	S. $\frac{17{\cdot}5}{17{\cdot}5}$
0	31°·6	1·0248	0	41°·6	1·0270
14	36°·5	1·0265	27	40°·0	1·0270
27	33°·3		54	38°·6	1·0270
33	35°·6	1·0268			
38	36°·4	1·0270			
437	31°·6	1·0268	437	31°·9	1·0270
820	30°·4	1·0269	820	30°·2	1·0270
1093	30°·1	1·0269	1093	30°·1	1·0271
1367	30°·1	1·0270			

On examining the figures of both stations, one cannot fail remarking that from the depth of 100 fathoms to the bottom the temperature and specific gravity of water are almost the same. In the upper strata of station No. 34 the water on the surface is the same as at the bottom, visible Gulf Stream water; while at station No. 31 the water of the upper strata is much influenced by fresh water from ice and precipitations. It is remarkable that on that station the superficial water is cold; then comes a warm layer, then again cold, then warm and cold again.

Cold water at the lower strata at both stations has a temperature of 30°. Such a low temperature is not met in the Atlantic to the south of the Thomson ridge. The water acquires such a low temperature somewhere in these localities; it cannot be in the polar sea, notwithstanding its excessive cold, because the upper strata there have less density. I have discussed this question with Sir John Murray. He thinks that the cold layer of this region is supplied from the top water being cooled during the winter somewhere close to Spitsbergen, or to the south of it, where no water of less density interferes with the upper layers descending to the bottom, when it is properly cooled by the winter cold. I perfectly coincide with the opinion of the distinguished oceanographer, and I am of opinion that cold water must settle down the slope of the bottom close to Spitsbergen.

There is no voyager in the polar regions who has not his own story of bear-shooting. I could not sacrifice time in that sport, but there is such an abundance of polar bears that one cannot avoid having a shot at them. Fresh traces of the white bear are seen on almost every other ice-floe. Generally the track goes from one end of the floe to the other, and it looks as if the bear on his way goes straight, whether on water or a floe of ice. The bear usually makes a hole in the snow, and then lies down in it, so that you cannot see him from a short distance. When a ship passes he jumps out at once from his hole, and were it not for this one would pass him by unnoticed.

The moment we entered the ice in June, we saw two bears, but we

were very busy at that time with the study of the ice, so that we let them go their own way. When we came next into the ice, in August, we saw some bears almost every day. One bear was upon the floe when we approached. Our sportsman wounded him, but the bear escaped to the other end of the floe, and swam over the lane. By that time the *Yermak* approached the place where the bear was, and it was shot dead by a bullet from the forecastle of the ship. We stayed a quarter of an hour to get him on board. On another occasion three

MORENAS ON THE ICEBERG.

bears approached the ship at four o'clock in the morning; afterwards they proved to be a she-bear with her cub, and a he-bear. The watchman roused the sportsman, who at once pursued the bears. The cub was wounded first, in the leg, and it was most pathetic to see the mother-bear help her baby to get over the ridges. Another bullet killed the cub. The mother-bear, imagining that it was the he-bear that had killed the baby, rushed violently upon the he-bear, and ripped up his skin for more than a foot in length. This gave to our sportsman the chance to approach and finish with both bears.

The most interesting part of the experiment is the behaviour of the ship herself in the ice; the question whether or not the steel ice-breaker can break polar ice and stand its pressure. Experiments in the Baltic have shown that a great deal of power is required to propel the ship through the ice. Ice-ridges in deep water, in the Baltic, never attain any considerable height, but the ice is difficult to pass through; and it happens that the ice-field, which is no higher than one or two feet, requires more power than the *Yermak* can supply. In these cases we were obliged to move the ship astern, and charge at full speed, gaining sometimes less than the half-length of the ship at a charge. The fact is, that the Baltic ice, being composed of pieces no more than 2 to 3 feet thick, gives a very great skin-resistance to the ship. This was so to such an extent that other ships following the *Yermak* in the canal opened by her, on some occasions could scarcely proceed with full speed.

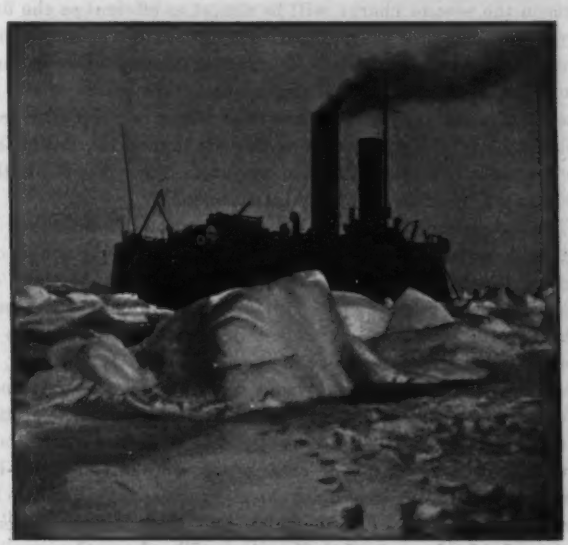
It is quite another proceeding, breaking the polar ice. In some places of the Baltic the ice-field is uninterrupted from one shore to another. In the arctic seas the ice is broken. Floes of ice might be several miles or several fathoms in length. Between ice-floes are the lanes, which are very irregular. Sometimes ice-floes are pressed against each other, and sometimes not. When the ice is not pressed, the progress of the ship is very easy. Floes of ice even a mile long move away and give passage to the ship. The sharp projecting angles of the floes break very easily, and sometimes it is preferable to shorten the way by cutting a floe right through. Thick polar ice looks very heavy and strong, and when walking on it, one cannot imagine that such a heavy thing could be broken. But the fact is that even ice 14 feet thick cracks when charged at by the ship, provided there is room to remove broken parts.

The lower part of the polar floe has constantly, more or less, the same temperature, while the temperature of the surface varies with the temperature of the air, which sometimes produces the cracks, and sometimes prepares the ice for cracking. The moment the ship charges the ice, it cracks at the place at which it might crack in half an hour itself with another change of temperature of a degree or so, or with the beginning of pressure. The big floe cracks more easily than the small floe, which sometimes is pushed by the ship, and goes in front until it manages somehow to pass on one side of the ship or the other.

Fields of hummocky ice are liable to crack even more than fields of plain ice. In charging that ice, the ship's bow rises to 9 feet; then the field cracks, the ship falls down, and goes ahead, moving aside the *débris* of the ice-field. It is a most exciting scene to see some of the big pieces of ice falling down into the water, and the others coming to the surface from a great depth, every detached piece trying to find a new position, while the ship itself, being always pushed ahead by her machinery, gradually advances, maybe rises again, and gives another

crack to the field ice. We took some cinematograph pictures, which show how much the ship lifts herself up in the ice, and that gives us means of calculating what weight is applied to crack the floe of ice. If the ice is in the period of pressure, progress is not so easy; on one occasion it took me four hours to make 2 miles, while usually the ship went, by zigzags, with a speed of 3½ knots, making good 2½ knots an hour.

There is a great difference in ice-breaking in the Baltic sea and the polar regions. Hummocks in the Baltic sea are never high above the level, but sometimes they are very deep. According to our measurement they go down to as much as 20 feet. On one occasion we measured



YERMAK IN HEAVY ICE.

27 feet down and 6 feet up, the total being 33 feet. Such hummocks are composed of pieces 1 to 3 feet thick. Many hummocks are formed at the time when ice is moved by the swell; the result of this is that every piece of ice finds its best position, and the whole hummock is very compact. When the ship charges into it it does not always form long cracks, but breaks under the ship, producing no heavy effect upon her skin. When the ship passes half of its length in such a floe, she touches so many fragments of ice that they stop the progress of the ship by the friction and the pressure upon the skin of the fore part of the ship. When the ship stops, there is no other way than to go back and charge again. This time, before the bow of the ship touches the solid ice it has

to run through 100 feet or so of broken ice; that diminishes very much the speed of the ship, which on a second charge may make a very little headway. It happens sometimes that after the ship stops going ahead it won't go back, and it takes half an hour, until by reversing the engines ahead and astern one can get the ship out of this disagreeable standstill position. From time to time it happens that one has to get the use of an ice-anchor to move the ship astern. Nothing like this happens in the polar ice, which breaks into big pieces, and consequently there is not so much skin-resistance. The moment you stop your engines the ship goes back herself, and there will be no fragments left which could stop her progress when she charges the second time. For this reason the second charge will be almost as efficient as the first, and we never wanted an ice-cage to move the ship in the polar region.

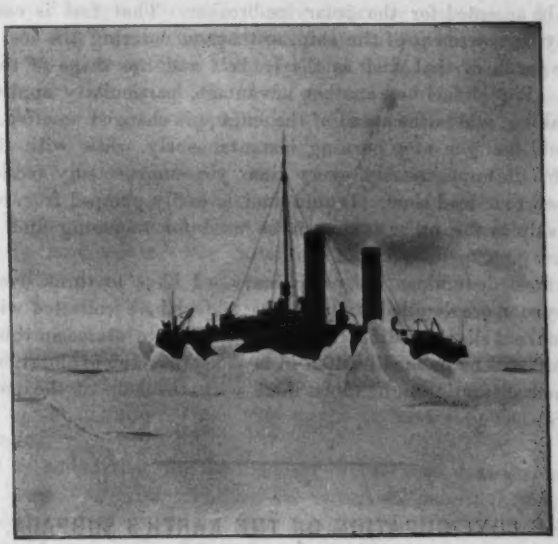
Fresh-water ice in the Baltic is stronger than the salt-water ice in the arctic sea, but, owing to the dimensions of the pieces of the ice, the ship never receives such tremendous local blows in the Baltic sea as in the polar region. The general conclusion is that in the Baltic the force of the engine is required, while in the arctic the strength of the construction is the main thing to pay attention to.

It is most interesting to decide the question whether my idea of exploring the polar regions by means of ice-breakers is sound or not; whether in future explorers of the arctic should stick to their sledges and dogs, or trust themselves to the drifting ships of Dr. Nansen, or embark upon the strong ice-breakers. It looks as if the voyage on the ice-breaker is the most expensive of the three, but it saves time, which, if properly calculated, is always money. If we come to the conclusion that the ice-breaker is to be used for the exploration of the arctic, then comes the question, what sort of ice-breaker is good for that purpose? Shall we repeat the *Yermak*, or shall we give to the new ice-breaker another feature, basing ourselves upon the lesson given us by the experiments of the *Yermak* in the polar ice? Surely the *Yermak* is not the last work of science in that direction. The forward propeller was very much praised in America, and proved to be useful in the Baltic. But when we first entered the ice in June last, I felt at once that the fore propeller had to be removed, which was done on my returning to Newcastle. No forward propeller could stand the charges of the ice-breaker into the polar ice, and if it does so it stops the progress of the ship. Of course the *Yermak* is meant for double service; for the Baltic the forward propeller is useful, and for the arctic it is objectionable. We have either to sacrifice one or the other, but if a special ice-breaker has to be built for the arctic, it ought to be without forward propeller.

With regard to the strength of the ship, it is not a question of the weight of material, it is a question of knowledge and experience, and I believe that Messrs. Armstrong, Whitworth & Co. have learnt very much since our last trial in the polar ice. One cannot make a mistake

in building a ship too strong. The *Yermak* had to be improved in that respect after the first trial, and we have to do something more now. Had it not been for this, I would not have returned without penetrating farther on, in order to study that unknown region a little more.

The angle of the stem, 70° from the vertical line, proved to be a good one; 20° for the sides of the ship is also not bad, but it should run a bit higher than on board the *Yermak*, because the ship receives with her sides tremendous blows; 25° would be still more profitable. With such a shape of ship one would expect that the ship would roll heavily at sea. I did not dare to give to the *Yermak* any bilge keel, but I think it would do no harm to the ice-breaking qualities if the



YERMAK CHARGING THE ICE.

ship was supplied with two short bilge keels on the last third of the length of the ship; it would improve, somehow, her rolling quality; also a big rolling chamber would be useful.

The proportion of the *Yermak* is 1 to $4\frac{1}{4}$; it is such because the ship has to enter the port of St. Petersburg. For the polar ice-breaker finer lines would be better, but finer lines increase the weight of the ship. I believe 1 to 5 would be a good proportion.

The size of the ship depends very much on the power required, and the quantity of coal-supply. The bigger the ship, the more powerful will be the engines, and the greater the supply of coals. During our work in the arctic, we seldom used our full power; the ship progressed

fairly well with the engines working slow. However, sometimes it happened, during the pressure of the ice, that full power was required. In such a case a ship with weak engines has to wait, but it should not be more than a few hours. The progress of the ice-breaker with smaller engines will not be so quick; anyhow, it will be progress. I may say, the less power you have, the more patience you want, in going through the polar ices. The *Fram* had 200 horse-power; it was not enough for a good ice-breaker, but I believe 2500 horse-power will be sufficient for fairly good progress through the ice.

The distance that one can go through the ice will depend upon the quantity of fuel, and as liquid fuel is more efficient than coal, it should be accepted for the polar ice-breaker. That fuel is easily put into any compartment of the ship, so that, on entering the ice, one can have as much of that fuel as the ice-belt and the shape of the vessel allows. Liquid fuel has another advantage, particularly applicable to ice-breaking, where the speed of the engine is changed so often. With the liquid fuel you stop burning instantaneously, while with the coal, you burn it unnecessarily every time you unexpectedly reduce your full speed to a dead slow. Liquid fuel is easily pumped from one part of the ship to the other, and can be used for trimming and heeling purposes.

All these deductions are preliminary. I have to think over them, and maybe more detailed study of the material we collected will force me to make a slight modification of what I have stated in this paper. But there will be no modification in my idea that the exploration of the arctic and antarctic ought to be done with the help of the polar ice-breakers.

ON THE CONFIGURATION OF THE EARTH'S SURFACE, WITH SPECIAL REFERENCE TO THE BRITISH ISLANDS.

By the Right Hon. Sir JOHN LUBBOCK, Bart., M.P., F.R.S., D.C.L., LL.D.

THE Geographical Society did me the honour of inserting in the *Journal* for December, 1895, a memorandum in which I amplified a suggestion, originally made in 1887, that the tendency of peninsulas to point to the south might be explained by the preponderance of water in the southern hemisphere, which M. Adhemar has suggested may be due to the alteration of the centre of gravity of the Earth caused by the great southern cupola of ice; and endeavoured to meet an objection made to me privately by my friend Mr. Francis Galton, by pointing out that if mountain chains are mainly the result of compression due to the contraction of the Earth, we must expect that there will be two series of folds, one at a right angle to the other.

Prof. Lapworth,* in a lecture on "The Face of the Earth," had already called attention to such intersecting folds, as also have Mr. Bertrand and Prof. Bonney; † Darwin also long ago ‡ called attention to the fact that volcanoes had to be arranged "on one line, or on a set of short parallel lines, intersecting at nearly right angles." But none of them offered any explanation of the fact that they cross one another at right angles.

Dr. Gregory, in a very interesting paper on "The Plan of the Earth and its Causes," § objects to the suggestions in my paper on two main grounds. In the first place, he says we should expect from it "that the main geographical structure lines in the northern and southern hemispheres would be symmetrical." That was also my own idea at first, and, in fact, it prevented me for some years from making the suggestion contained in my memorandum. Dr. Gregory must, however, have overlooked the fact that one object of my paper was precisely to show why they would not be symmetrical, and I will not therefore go over the same ground again.

Dr. Gregory's second and "still more serious objection" is, that "The primitive lines of these systems often coincide with features of modern development, and are inconsistent with the old-established geographical arrangements. For instance, Prof. Darwin quotes the trend of the western coast of Europe from Spain to Norway as in accordance with his scheme. Prinz makes the primitive line here run exactly at right angles to Darwin's line; and geological evidence favours Prinz. The coast-line from Spain to Norway is almost certainly of modern date, while the lines of wrinkling, both Hercynian and Alpine, run transversely to the direction which they ought to have followed if due to tidal strain."

And he adds "that the double folds are all true causes seems probable. What is doubtful is whether any extensive trace of their influence can be discerned in the present distribution of land and water. A map of the world in early Cambrian times might show the influence of these pre-geological incidents, but their geographical effects seem to have been obliterated by the changes of geological times."

I will not here discuss the torsion lines due to the Moon's action, which have been suggested by Prof. G. H. Darwin,‖ and which he considers would raise wrinkles on the surface running in a direction perpendicular to the axis of greatest pressure, *i.e.* north and south at the equator, with a trend in the north to the north-east, and the south to the south-west.

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* *Geog. Jour.*, 1894.

† *Bull. Soc. Geol. France*, 1892.

‡ 'Geol. Obs.' (1851), p. 126.

§ *Geog. Jour.*, 1899.

‖ 'On Problems connected with the Tides of a Viscous Spheroid.'

As regards Dr. Gregory's suggestion,* however, that the geographical effects of "pre-geological" or early geological incidents could be "obliterated by the changes of geological times," I may remark that folds once started would establish lines of weakness, and thus tend, as Mr. Bertrand has shown,† to repeat themselves again and again, though not, of course, to the exclusion of others.

It is probable, then, that as soon as the contraction due to the cooling of the Earth began to throw the surface into wrinkles, these would take a north-eastern or south-western direction. How prevalent such lines are, a glance at the map will show. I need only mention the west coast of Europe, and North Africa from North Cape to Cape Blanco, the eastern coast of Asia from Kamskatka to Siam, and the eastern coast of North America from Greenland to Florida. But I have shown, or attempted to show, that ridges in any direction due to such a cause would be accompanied by others approximately at right angles to them. Such are the west coast of North America from north of British Columbia to Panama, the coast of Labrador, the western coast of Greenland, the western coast of Great Britain, the Red Sea, etc. There are no other lines of direction comparable with these in importance.

We cannot expect these lines to be straight or the directions to be mathematically true. Various circumstances would give rise to considerable deviations. Moreover, as the evidence shows, the lines have a tendency to bifurcate and reunite.

Dr. Gregory says that "Prof. Lapworth lays stress on 'the great Rocky Mountain-Andes fold, . . . the longest and most continuous crust-fold of the present day.' The agreement was important so long as the Rocky mountains and the Andes were regarded as a single mountain system, connected into a continuous line by a mountain axis running north and south across Central America. But that axial mountain chain in Central America is a myth. Central America is traversed by a series of ridges which run east and west, and not north and south. The watershed, it is true, runs along the Pacific border, but that is due to a movement later than the mountain ridges, which are thus truncated. The continuation of the Andes is in the mountains of Venezuela, not in North America or the Sierra Nevada."

But may not the Andes be continued both in the Rocky mountains and in the Alps of Venezuela? Very instructive experiments, as showing the manner in which the contraction of the Earth would throw up ridges, have been made by Sir I. Hall, Favre, Cadell, and others. In all these cases, however, so far as I am aware, the pressure was in one direction only, whereas in nature there would be compression in two directions at right angles to one another. I have already suggested

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* *Phil. Trans.*, 1879, p. 529.

† *Bull. Soc. Geol. France*, 1892.

this in my book on the 'Beauties of Nature' (1892), but for the sake of clearness may perhaps repeat it here.

"If the elevation of a chain of mountains be due to the causes suggested in p. 214 (*i.e.* the contraction of the Earth through cooling, and consequent folding of the surface), it is evident—though, so far as I am aware, stress has not hitherto been laid upon this—that the compression and consequent folding of the strata would not be in the direction AB only, but also at right angles to it, in the direction AC, though the amount of folding might be greater in one direction than in the other. Thus in the case of Switzerland, while the main folds run south-west by north-east, there would be others at right angles to the main axis. The complex structure of the Swiss mountains may be partly due to the co-existence of these two directions of pressure at right angles to one another. The presence of a fold so originating would often divert the river to a course more or less nearly at right angles to its original direction." *

Nature has provided for us an admirable illustration in the case of the Jura. It will be seen there that the folds do not take the form of absolutely straight and parallel lines, but of elongated ellipses or lenses often bifurcating and then reuniting. The main folds run south-west and north-east, with cross-lines, as, for instance, the depression from Pontarlier by Jougne to Vallorbe; that by Delle, Porrentruy, St. Ursanne, and Biel; that by Basle, Liestal, and Olten, etc., all of which have been adopted by rivers and railway companies.

Now let us apply these considerations to a special part of the globe, and it is natural to select our own country.

I will begin with Scotland. The most remarkable geographical feature of North Britain is surely the Great Glen—that remarkable valley which, commencing in the south-west with the Firth of Lorn and continued through Loch Linnhe, Loch Eil, Loch Lochy, Loch Ness, and the Firth of Inverness, almost divides Scotland in two. It is, moreover, only one of many. Beginning with the north-west, we have the outer coast of the Hebrides, the Minch, Sleat sound, the eastern coast of Sutherland and Caithness, the line of Loch Awe, Loch Lydoch, Loch Ericht and the Spey, Loch Fyne and Loch Tay, the Solway Firth, etc.

The cross-lines, or those running from north-west to south-east, if shorter, are also numerous. In Sutherlandshire Loch Shin and Loch More, and coming southwards the two Loch Brooms, Loch Ewe and Loch Maree, the Sound of Harris and Loch Snizort, Loch Hourn, the Sound of Mull, the North Channel, Loch Ryan, and Luce bay, Wigtown bay, etc.

The predominant effect of these two lines on the geography of Scotland has not hitherto, I think, received the attention it deserves.

* 'Beauties of Nature,' p. 295.

In England and Wales we have, for the north-east and south-west lines, the Menai straits and north coast of Carnarvon, the north coast of Cardigan and Pembroke, the line of the Bristol Channel from Gloucester to Cape Cornwall, and some of the principal hill ranges, the Cheviots, the Cotteswolds, the Chilterns, etc. While for the transverse lines I might mention the Weaver and lower Mersey, the lower Dee, the Clwyd, further south the upper Severn, the Wye, the western Colne, and several other Thames tributaries, Southampton Water, etc.

Many of the great faults which cross the country for miles, as, for instance, the two great faults which cross the south of Scotland from sea to sea, also follow one or other of these two main lines of disturbance. I might also refer to the general strike of the Secondary strata from the Bristol Channel to the Wash.

I submit, then, that, so far from its being doubtful whether any extensive trace of these double folds can be discerned in the present distribution of land and water, the effect is still clearly shown on the Earth's surface, and that in the British Islands we have a most instructive illustration.

There is, however, of course, nothing in this which conflicts with Mr. Green and Dr. Gregory's very interesting and ingenious suggestions as to the tetrahedral form of the Earth.

A RECORD OF EXPLORATION IN NORTH-EAST AFRICA.*

THE appearance of a detailed narrative, by Lieuts. Vannutelli and Citerni, of the late Captain Bòttego's second great journey in East Africa, supplies a welcome addition to our knowledge of one of the most interesting regions of the whole continent. The expedition which it describes was, apart from the lamented death of the leader, one of the most successful and fruitful in geographical results that have been accomplished within recent times; and although more than two years have elapsed since the return of the survivors, the interest of the record has suffered no diminution in the interval.

The main objective of the journey was, as is well known, the solution of the much-debated question of the termination of the river Omo, whose headstreams, flowing southwards from the Abyssinian highlands, have been for many years known to travellers from that direction. Not only was this problem satisfactorily solved, but other points of interest connected with the lakes and rivers of this part of Africa were for the first time brought to light. After a brief introduction, in which the history

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* 'Seconda Spedizione Bòttego. L'Omo.' By L. Vannutelli and C. Citerni. Milan: Hoepli. 1899.

of the Omo problem is concisely told,* the authors, the sole survivors of the four Europeans who set out from Brava in 1895, give a connected narrative of the course of the expedition down to the arrival at Zeila nearly two years later. The early stages of the route—from Brava to Logh on the Juba, and thence west up the valley of the Daua—led through country not entirely unknown, and must be passed over here, though the narrative contains valuable matter relating to the geography of the country, and the varied tribes which inhabit it. Entirely new ground was first entered in the neighbourhood of the lake Abbaya of Prince Ruspoli and Dr. Donaldson Smith. Here the travellers were in a region of mountains and lakes, meriting the title of an African Switzerland, of whose beauty and fertility they are never tired of discoursing. Keeping to the east of the Sagan, the feeder of Lake Stefanie, and thus leaving Lake Chamo (Abbaya) for the time unvisited, though seen from a distance, they soon reached a still larger basin girt with high mountains, its surface broken by numerous islands, which, like the shores, were clothed with luxuriant vegetation. Elephants and other game were frequently seen. The islands were inhabited by a tribe of skilled canoemen, with whom, after some fighting, friendship was at last established. During the circumnavigation of the lake, it was found to be separated from Lake Chamo by a strip of ground only a couple of miles wide, and generally low. The larger lake (Pagade, or Margherita) is drained into the smaller by the river Walo. Lieut. Vannutelli, who explored a part of the eastern side of Lake Chamo, was of opinion that the stream on this side entered the lake, instead of issuing from it, as Dr. Donaldson Smith thought; but the latter view is accepted in the maps which accompany the work.

In order to reach the Omo near the lowest known point on its course, it was now necessary to strike west across a mountainous region in which constant rain was experienced. The natives showed themselves suspicious, by reason of the alarm spread abroad by the doings of Abyssinian raiding-parties, with whom the Italians were supposed to have some connection. After constant ascents and descents, during which a massive peak named Guge, nearly 14,000 feet high, was passed, streams flowing to the Omo—or "Uma," as the object of search began here to be known to the natives—were reached.† A new danger arose from the presence of an Abyssinian force on the Omo, just ahead of the expedition, but the wild mountains on either hand made it necessary to

* Mr. James MacQueen, whose views on the question are referred to in the introduction, is erroneously spoken of as an American. Although he resided for a time in the West Indies, Mr. MacQueen was by birth a Scotchman, and the greater part of his career was connected with this country.

† The name "Shambara," heard of by Borelli as that of the lake which received the Omo, was found in use here and along the Omo to designate an uninhabited tract of country.

keep straight on. Arrived at length in the narrow, thickly wooded valley of the Omo, the travellers turned at once towards its mouth, and succeeded in eluding their dangerous neighbours. Leaving the river for a time, they had to fight their way through the mountains, inhabited, for the first time, by tribes of negroid character. Again reaching the Omo on its exit from the mountains, the expedition followed down its eastern bank—round the great northerly curve, which seems to have led Dr. Donaldson Smith to mistake a tributary for the main stream—until at last the sight of Lake Rudolf told the travellers that their chief task was accomplished.

Although the chapters which tell of the march through the Alpine regions of East Africa are perhaps the most interesting part of the book, the subsequent portion, dealing with the exploration of the headstreams of the Sobat and the ascent to the Abyssinian plateau, is of scarcely less importance. The main narrative is followed by extracts from a journal kept by Dr. Sacchi on his fatal attempt to reach the coast from Lake Rudolf, with a map of his itinerary through the Boran country east of Lake Stefanie. The results of the surveys carried out during the whole march are shown on five large-scale sectional maps, based on 132 observations for latitude and 63 for longitude, which are fully discussed by Prof. Millosevich in an appendix. Other appendices give the scientific results of the expedition in other directions, which, valuable as they are, would have been still more complete had it not been for the loss of a part of the notes during the attack on the party near the Abyssinian frontier. The sections dealing with meteorology and geology, the latter illustrated by a special map based on the collections of Dr. Sacchi, are of particular value. The whole of the Alpine region of Lake Margherita and the Omo falls within the area of recent volcanic rocks, while in the Juba valley older volcanic rocks with calcareous and cretaceous strata of Mesozoic age are largely developed.

DISTRIBUTION OF AGRICULTURAL PRODUCTS AND LIVE STOCK OUTSIDE THE TROPICS.*

By A. J. HERBERTSON, D.Sc.

THE botanist who studies the distribution of plants usually eliminates all consideration of the plants cultivated by man, as vitiating his inquiry. The present work is an elaborate study, based on statistics, of the distribution of cultivated plants, and is the first complete work of its kind.

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* 'Die Landbauzonen der aussertropischen Länder.' Auf Grund der statistischen Quellenwerke dargestellt von Th. H. Engelbrecht. In three volumes: vol. i. Text, pp. xi., 279; vol. ii., Statistics, pp. x., 383; vol. iii., Atlas, pp. viii., 79 maps. Berlin. 1899. Dietrich Reimer (Ernst Vohsen).

Originally inspired by the increase of American cereals in European markets twenty years ago, and planned as a study of the crops in the two continents, the work has been extended to include all the crops and live stock of the great cereal-producing regions of the World outside the tropics. The statistics are, in the first place, those for 1882 for most European countries, but they are compared with both earlier and more recent statistics in most countries, so that the second volume, which includes the statistical tables, is a most valuable source of accurate information as to the area growing cereals and the number of live stock, not merely in comparatively recent years, but also in the past.

The fault we find with the statistics is that for most countries single years have been taken. In the case of Argentina, for instance, the fluctuations from year to year in the wheat-producing area are so great that a comparison of one pair of years would lead to apparently diametrically opposite conclusions from that of another pair of years. In a work of this magnitude the mean values should have been calculated for a series of years. This would no doubt have involved much labour, but it would have given a greater and more lasting value to the elaborate maps which form the third part of the work.

The author has not shirked labour, for he has expressed the statistics in relative as well as in absolute figures. He has chosen what seems to us very unfortunate standards of comparison—in the case of agricultural products, the area sown with cereals (*Halmgetreide*, the northern cereals, excluding the *Hackgetreide*, the tropical cereals, such as maize and rice); in the case of live stock, the number of cattle. The former are useful in showing the relative importance of any particular crop compared with the total cereal crop in any region, but they give no indication of the relative importance of the particular crop in different regions, which is by far the most important consideration for geographical purposes. It is greatly to be regretted that the author should have considered the plan of the statistics to the common denominator of the total area of each region only to dismiss it. This is by far the most satisfactory method of treatment for cartographic purposes, except in cases where the data and the scale of the maps permit the delimitation of uncultivated lands, when the arable area can be used as the common denominator in the case of agricultural products, and the results of the calculations shown over only the arable region, and not over the whole political region of which it forms part.

The author's method leads to emphasizing the less of two important considerations, the one which can be most easily appreciated by a comparison of a series of maps. His maps show that in 1882, with hardly an exception, more than half the cereal-producing land of Scotland, Wales, and Ireland was cultivated for oats, and that in Suffolk less than 10 per cent. of this land was so utilized. This is useful if we have a map showing that in, say, Ross and Cromarty 2 per cent., and in Suffolk

37 per cent., of the total area produced cereals, as happened on the average from 1891 to 1895. He gives no such map. He does not even give the statistics that would have permitted the calculation of data from which such a map could be constructed, although it would have been easy to add a row of areas, at least in most countries dealt with. One has to obtain such statistics from other sources to discover that the same proportions of the surface of Ross and Cromarty and of Suffolk are sown with oats, namely 1·7 per cent., for in the former county 64·7, and in the latter only 5·2, per cent. of land growing cereals yielded oats. The author would say that the map based on proportion of total area growing oats would indicate that oats were more important in Suffolk than Ross and Cromarty, and would conceal the fact that they were by far the most important cereal in the latter county. Surely a comparison of wheat, barley, and oat maps would at once indicate this fact. The method of first eliminating, both in statistical tables and on the map, the uncultivated area would overcome this difficulty, and permit both the facts of the northern county having few crops and those chiefly oats, to be illustrated on one map. As it is, we have no means of appreciating from the atlas the intensity of cultivation of any particular crop in different regions. This would have been possible, had Mr. Engelbrecht calculated and depicted for each region the proportion of its cereal-producing land to the whole, and the number of cattle per unit area, by comparing such maps with those showing the relative proportion of one cereal crop to all, and of other live stock to cattle. It would be, however, much more difficult to obtain all the different interpretations of the facts from such a series of maps than from the other series, where everything was expressed in terms of the total area.

Although we think the relative tables and the maps would have been more useful if treated differently, yet the great excellence of all parts of this monumental work must not be overlooked. The tables are full of invaluable figures, the text of important observations, and the maps reveal many interesting features of distribution. Some of the maps, showing the distribution of two different crops, *e.g.* wheat and sugar in Australia, those with lines showing regions where wheat predominates over rye in Europe, are most instructive. Innumerable relationships are discussed in the text between climate and crops, and between one crop and other plants, and some of these are illustrated in the atlas.

On numerous maps selected isotherms are drawn, and in many cases these run close to the boundary of cultivation. For instance, hardly any maize is grown in Europe where the mean temperature is under 19° C. in June, in Australia where under 18° C. in January, but in North America maize is grown in all of the United States, in many of which the mean temperature in June is lower than this. In the case of Australia, especially, some rainfall lines would have proved valuable

addition, *e.g.* that of 15 inches per annum, outside of which little wheat can be grown; and 30 inches, which approximately forms the western limit of maize in the east; and 40 inches, which bounds the region of more intensive maize cultivation. The increase of goats, mules, and asses in the drier areas is graphically shown on the maps, and would have been made clearer by a series of isohyets.

On many of the maps the distribution of a number of forest trees is indicated and correlated with that of the cultivated plants. This we consider a most valuable feature of the work. For instance, noting that the northern limits of the cultivation of oats almost coincides with that of the breaking buckthorn (*Rhamnus frangula*, L.) in European Asia, that its southern limit is almost coincident with the southern limits of the bird cherry (*Prunus padus*, L.), we may assume that the region between the natural limits of the growth of these trees in Siberia is a possible area for oat culture, and beyond that it would probably fail.

From a geographical point of view, the study of plant associations is more important than the study of the distribution of an individual species, and has great economic possibilities, so much so that in recent years special surveys of natural biological conditions have been started in several of the American states for the benefit of the farmer. This plan of comparing the distribution of cultivated plants with that of natural plants may be looked on as a special and most valuable application of the method. In this way it becomes possible to say, from the study of the natural flora, what the chances of success in cultivating special economic plants will be.

Two other valuable features of this great work must be noted: (1) There is a discussion of changes in the intensity of cultivation in the past few decades, of which the diminution of wheat in our own country and the increase of wheat in the more recently settled lands of the globe is the most striking example; but the retreat of the polar limits of wheat, the vine, and cotton with the increase of transport facilities is quite as interesting, if less known. (2) The first map and part of the introductory text deals with the different extra-tropical cultivation belts, which Mr. Engelbrecht divides into (*a*) arctic, (*b*) arctic and antarctic barley belts, (*c*) the oat belts, (*d*) the steppes of Central Asia and Southern Russia, (*e*) the maize belts, (*f*) the sub-tropical barley belt, (*g*) the sub-tropical cotton belt, and (*h*) the sub-tropical sugar-cane belt.

LIEUT. KOZLOFF'S EXPEDITION TO CENTRAL ASIA.

At a meeting of the Russian Geographical Society on November 22, an account was given of the expedition which the Society sent out last spring to continue the exploration of Central Asia. It was entrusted to Lieut. P. Kozloff, the well-known explorer, who has made several expeditions under Prjevalski and General Pevtsoff, and later on in company with Roborovsky. He was accompanied by M. Koznakoff, and a naturalist, M. Ladyghin. According to the information just received from Kobdo, the work of the expedition was as follows.

On June 23 the expedition was at the Altai Stanitsa, where the last preparations for the long journey into the deserts were completed. The expedition left this place on the 26th, the caravan consisting of 18 men, 54 camels, and 14 horses, and began its explorations in a very imperfectly known region of the Great Altai. Following the banks of the river Bukhtarma, they gradually ascended to the limits of perpetual snow and glaciers, and reached an undulating plateau, which was covered with grass that had already assumed its autumn tints. There was very little animal-life, though water was in abundance, the plateau being dotted with a great number of small lakes. The whole was of a gloomy aspect. Taking advantage of a day's halt, they explored, in a boat made of linen and cork which they had brought with them, one of these lakes—Khaluzyn-nor.

At the western end of the Ulan-daba pass, which is on the frontier of Russia, the expedition divided into two parties. The larger one, under Lieut. Kozloff, crossed the range, and on its eastern slope entered the basin of the river Kobdo, which is under the influence of the dry climate of Mongolia, and widely differs from that of the Bukhtarma. The river Kobdo was reached on August 15. It is 350 feet wide, and is very rapid. The valley is covered with woods. Here and there one sees small lakes and marshes, which are peopled with birds. The whole length of the river Kobdo is about 340 miles. It takes its origin in the glaciers of the Southern Altai, and flows afterwards on the high plains where it enters the lake Kara-usu. The caravan crossed the river by means of small rafts, and, leaving the valley, entered a rugged mountainous region intersected by deep valleys containing rapid torrents. After a four days' march the travellers approached the snow-clad mountains of Gurban-tsasatu, which are held in high respect by the Mongols. Some Mongols were found staying at this place, and guides were taken from among them. After several days' rapid march, without halts, the expedition saw at last, on August 24, from the top of a hill, the wide valley Buyuntu, with the little town of Kobdo.

The other party of the expedition, consisting of Koznakoff, Ladyghin, and a few men, lightly equipped, moved south from the Kobdo highway. Going through the valleys of the rivers Tsagan-gol and Kobdo, as far as the lakes at the sources of the latter, they crossed the water-parting between Kobdo and the Saksai, then the headwaters of the Buyuntu, and, finally passing by Lake Dain-nor, they reached the town of Kobdo. The route lay through a wild mountain region along a small footpath, which wound along the stony slopes of the valleys. The head valley of the river Tsagan-gol is not wider than 2 or 3 miles, and has, broadly speaking, a direction towards the east. The river itself, the muddy water of which rapidly runs between low banks, has a width of about 140 feet. The valley is inhabited by nomad Uryankhai Kalmuks. Further east the valley appears still more desert, the surrounding mountains are treeless, the ground is occasionally covered with salt, and both the vegetation and the animal-life became poorer and poorer as the party approached the place where the Tsagan-gol joins the Kobdo

river. Further on they ascended the river Kobdo, which flows rapidly between wooded and hilly banks. Here, in contrast with the Tsagan-gol valley, the slopes of the hills are covered with trees, and there is plenty of rich meadows and pastures.

Continuing their journey up the Kobdo river, in a south-western direction, the party came to the spot where the river forms two small lakes, on the banks of which there are several Kirghiz villages. The lower Kobdo lake has an irregular elongated form, stretching 10 miles from east to west, with a width of about 5½ miles. There are in it fifteen islands, of which some are from 2 to 2½ miles long. Taking advantage of the boat which they brought with them, the explorers made a series of soundings of the lake, and visited the islands. The upper lake is connected with the lower by a rapid watercourse, 420 feet wide. The upper lake proved much larger than it was supposed to be; its length is about 16½ miles, and its width 4 miles; its depth attains 18 fathoms. From these lakes the party travelled to Lake Dain-nor, and found on the way numbers of graves with ancient tombstones. The circumference of this last lake is 13 miles, and it is 4 miles wide. The pass Ak-korum is not very high, but difficult, on account of the great quantity of water which covers the stony ground and makes it slippery. Further on the party went along the valley of the river Saksai, which they found similar in nature to the Tsagan-gol; then they reached the Buyuntu, which flows first in a stony bed amidst thickets of bushes, and further on in a narrow and low gorge. Here and there small terraces, covered with trees, chiefly willows and ash, were seen along the banks. The population consists of Olot-Kalmuks. The gorge was followed for about 50 miles, when the valley suddenly widened, attaining a width of about 7 miles; the mountains on both its sides became very low, and a grand view opened upon a high snow-clad range, which runs parallel to the gorge to the right of it. A little further on this second party saw Kobdo, which they reached on August 28, having covered 378 miles in twenty days. At Kobdo the expedition stayed for nine days, buying provisions for its further six months' journey; and then, on September 6, they started towards the east-south-east, along the northern foot of the Gobi Altai.

THE MONTHLY RECORD.

EUROPE.

Oxford Degree for Physical Geography.—Some years ago the University of Oxford instituted the degree of Bachelor of Science to be awarded for original research. It has just been conferred on Mr. H. N. Dickson, of New College, University Lecturer on Physical Geography, whose research took the form of a comprehensive study of the temperature and salinity of the surface water of the North Atlantic, with special reference to seasonal variations and the influence exercised on the climate of Western Europe. The result is to throw much light on the changes in the circulation of the ocean according to the season, and on the interaction of sea-surface temperature and climate. The examiners were Sir John Murray and Prof. Odling.

The Birmingham Water-supply from Wales.—An interesting account of the Birmingham water-supply scheme, now in course of execution, appears in the fifteenth volume of the *Proceedings of the Royal Institution of Great Britain*,

being a paper read last year before the Institution by Mr. James Mansergh. The drainage area, over which control was obtained from Parliament, lies in the western corner of Radnorshire, with parts of neighbouring counties, including the basins of the Elan and Claerwen, western feeders of the upper Wye, the distance to Birmingham by the route chosen being 80 miles, as compared with 100 miles from Thirlmere to Manchester, and 66 from Vyrnwy to Liverpool. The projected Welsh scheme for London involves an aqueduct of 170 miles. The area of supply is 45,562 acres, while from the record of rainfall kept by the lord of the manor from 1871 onwards, the mean annual fall of a long series of years is taken as 68 inches, and that of three consecutive dry years as 55 inches. From this it is calculated that, allowing for evaporation and loss by overflow, a supply of seventy-five million gallons daily will be obtained, in addition to twenty-seven millions, the amount fixed as "compensation supply" for the river below the lowest dam. As the discharge at this spot has been estimated at only four and a half million gallons during very dry weather, the benefit to the river is evident, apart from the additional service done by obviating disastrous floods. The geological features of the area favour the operations for reservoir construction. At a point called Caban Coch, a little below the junction of the Elan and Claerwen, bands of hard grits and conglomerates cause a contraction of the valley, and point out the best spot for the construction of the lowest dam. This will be 122 feet high, and will impound the water for a distance of 4 miles up the Elan valley, and 2½ miles up that of the Claerwen. Spots have been chosen for the erection of five more dams higher up the valleys, two in that of the Elan, and three in that of the Claerwen, the positions being determined by the fact that they afford the greatest impounding capacity with the least amount of structural work. An interesting and unusual feature is the provision of a "submerged" dam within the lowest reservoir, so as to provide the necessary head of water (770 feet above ordnance datum) for the Birmingham supply in times of drought, while leaving that contained in the rest of the reservoir, at a lower level, available for the "compensation" supply to the river. At such times the former supply will be derived from the upper reservoirs, a drought of 180 days being thus provided for. The drainage area above Caban Coch is twice that dealt with in the case of Vyrnwy, and four times that of Thirlmere. In time of high flood, the discharge may amount to 700,000 cubic feet a minute, and the surplus water will pour over the whole 600 feet of the dam, with a depth of about 3 feet at the crest. Almost the whole collecting area consists of mountain pasture or moorland; but in the lower parts of the valleys a few small farmsteads will be submerged, as well as the church and old manor-house of Nant-gwillt and Cwm Elan House, once the residence of Shelley.

Anthropogeography of Corsica.—An instructive study, by Prof. Ratzel, of the effect produced by the physical geography of Corsica on the course of its history, appears in the *Annales de Géographie* for July 15 last. The writer begins by examining the influence exercised by the position of the island with respect to neighbouring lands, and to the enclosed basin of the Tyrrhenian sea, the historical importance of which has always been greater than that of the more open sea to the west of Corsica. By its more northerly position, Corsica was further removed than Sardinia from the influence of pre-Roman civilization, and was long placed at a disadvantage from the prior attention directed to the latter. Naturally, the island is most nearly connected with the Tuscan coast of Italy, being further removed from France, and still further from Spain. Its relations, however, with the nearest part of the Italian coast (Pisa) lasted for a comparatively short period (1098–1348), being followed by Genoese domination, while the rivalry between Genoa and

France finally brought about its connection with the latter. The shifting of political ascendency thus followed a regular course from E.S.E. (Rome) to N.N.W. (Marseilles and France). Although an island, Corsica was too small and too near other land-areas to maintain an independent existence, but its insularity has been sufficient to impress a decided character of their own on the life and thought of the inhabitants. As regards the physical structure of the island, the dominating fact is its division, broadly speaking, between the granitic area of the west and south and the schistose area of the north-east. The line of division is marked by an important depression, parallel with the principal lines of elevation, which was covered by the sea during the Tertiary epoch. The main water-parting of the island, nearer the west coast in the north, and the east in the south, plays a very different *rôle* in the granitic and schistose areas, presenting greater facilities for communication across it in the latter. The character of the surface in the two regions is also very different, the north-eastern section being composed of undulating heights running generally north and south, while the granitic area is a land of mountains rising abruptly from the sea in parallel ridges, forming long and narrow valleys, and gulfs cutting deeply into the coast-line. Socially it is the land of shepherds and "signori," whilst historically it lies off the track of great events. In the extreme north and south are minor areas, distinct in many ways from the rest of the island. The region of the north-east, though in area only a fourth part of the island, forms in history practically the whole of Corsica. In it one of the most important positions is occupied by Corte, the radiating centre of the principal lines of traffic, and the point of contact between the mountains and the coast-lands; and it contains as well a whole series of sites of historical importance. This region has a striking counterpart in the south-west of Sardinia, in which the co-ordination of geographical features, and the resulting historical phenomena, are strictly analogous. The concluding section of Prof. Ratzel's paper deals with the contrasts offered by the east and west coasts, and the reasons which make the latter, with its many indentations, an exception to the rule that a broken coast-line favours the development of a country.

ASIA.

New Surveyor-General of India.—The Indian Survey Notes for September, 1899, contain the announcement of the retirement from the post of Surveyor-General of Major-General C. Strahan, R.E., and of the appointment in his place of Lieut.-Colonel St. George C. Gore, previously Superintendent of Trigonometrical Surveys. General Strahan was the last officer in the active service of the Indian Government of the corps of engineers raised under the East India Company, the distinguished record of which is thus brought to a close by his retirement. He had served in the Survey Department for thirty-six years, during the last four and a half of which he had been at its head. An important part of his work had been connected with the topographical surveys of the Native States of Bundelkhand, Central India, etc., where the present system of plane-table surveying may be said to have been elaborated and brought to perfection. To this work he had devoted himself for no less than twenty years. The place of Colonel Gore as Superintendent of Trigonometrical Surveys is taken by Major S. G. Burrard, R.E., one of the officers entrusted a few years ago with the re-determination of the longitude of Madras. Another announcement is that of the death of Hira Singh, a native surveyor of the Department, who did much good work on and beyond the north-west frontier while attached to various military and other expeditions, including that of the Afghan Boundary Commission.

Rhinoceros Remains from Eastern Mongolia.—We have received from M. Obrucheff, the well-known Russian traveller, the copy of a pamphlet on the discovery of the remains of rhinoceros in Eastern Mongolia during his journey of 1892–94. The identity of the remains, which consist principally of a lower jaw with fragments of teeth, has only recently been established by Prof. Suess, whose report forms the first part of the brochure. They are of interest as establishing the fact that the sedimentary formation in which they occurred is a fresh-water deposit of at most Middle Tertiary age, and thus shedding valuable light on the geological history of Eastern Central Asia. M. Obrucheff gives a description of the geological features of the neighbourhood of the Khuldyin Gobi plateau, on the edge of which he discovered the remains. The plateau lies near the salt lake Iren-dabassun-nor, on the caravan route from Urga to Kalgan. Its border is much broken into isolated fragments, where the geological formation is easily determined. The upper layer is a whitish fine-grained conglomerate, beneath which is a whitish marl with intermixture of clay, etc., while the lowest layer is a brownish-red marl. The rhinoceros remains were found in the middle layer. From the general lie of the country, M. Obrucheff concludes that the strata of the Khuldyin Gobi, which occupy the lowest part of the whole region, form the oldest member of the extensive Gobi deposits of Eastern Mongolia. These being now proved, as above stated, to be of fresh-water origin, it is found that the ancient Inner Asiatic sea or series of lakes consisted from the beginning of fresh water, and existed during the latter half of the Tertiary period. These conclusions agree with those of Prof. Lóczy, the geologist of the Széchenyi expedition, though M. Obrucheff had before doubted the fresh-water character of the ancient sea, having taken the remains now described for those of a large fish.

The Geological Structure of the Malay Archipelago.—A concise summary of our present knowledge of the geology of the Malay archipelago, with especial reference to the main lines of tectonic structure, is given in the *Journal* of the Tokyo College of Science (vol. xi. part 2), by Prof. B. Koto. The basis of the description is Prof. Suess' chapter on the archipelago in 'Das Antlitz der Erde,' but Prof. Koto has extended and modified his account from the most recent researches. Beginning with the great Malayan arc, which extends from Burma to the vicinity of Timor and forms the outer portion of the archipelago, the writer traces in turn its various component parts, especially the great volcanic belt running through Sumatra, Java, etc. The outermost member he considers to run from Cheduba off the Arakan coast, through the Andamans and Nicobars to the line of islands which fringe the south-west coast of Sumatra, the volcanic belt being represented in the north by Narcondam and Barren island. In the east this seems to terminate in the island of Pantar, north-west of Timor, being separated by the latter and other islands near it (all remarkably free from volcanoes) from the volcanic arc of Banda, which may thus be regarded as independent of the great Malayan arc. Prof. Koto is inclined to cut short the Banda arc, which begins with Roma in the south-west, at the Banda group, believing that Wawani on Amboina cannot be established as an *active* volcano. On the final decision of this question it depends whether or not a connection exists between the volcanic chains of Banda and the Moluccas. Outside the Banda arc runs a parallel chain of islands from Kisser northwards—the shattered relic of an old mountain range, while a third external zone has also been indicated. This threefold arc, of which the inner zone is of young volcanic origin, has a striking counterpart in the lesser Antilles, and still more in the Riu-kiu islands. Within the great Malayan curve lie the three K-shaped islands of Borneo, Celebes, and Gilolo, the external resemblance of which is, however, only superficial. To the south their relation with the outer curve is

not clear, but their geologic lines converge unmistakably in the Philippine group, presenting a striking instance of "virgation." In the south-west Borneo possibly falls on the tectonic line which runs from the Malay peninsula through Banka and Billiton, while in its centre tectonic lines running from east to west have lately been discovered, and neo-volcanic rocks have unexpectedly been found to exist. The north-eastern peninsula of Celebes lies on the volcanic belt which, beginning in the Gulf of Tomini, runs north through Sangi, and in Mindanao joins the chain of the Moluccas to form the great volcanic belt of the Philippines. This is not considered by Prof. Koto to run the whole length of Luzon, but, after traversing its south-east section, to cross the sea to the extreme north-east corner. The other tectonic lines of the group are somewhat complicated. The map accompanying the paper is an excellent specimen of Japanese lithography.

AFRICA.

The Egyptian Problem.*—Although Mr. Silva White's recent work is written with avowed political motives, its aim being the advocacy of a British protectorate over Egypt, the political questions involved are so far bound up with geographical considerations that the book contains much matter of interest to geographers, as well as to the wider circles in which a subject so nearly affecting the future of the British Empire cannot fail to arouse attention. From first to last the author follows a continuous line of argument, in which he attempts to make each step the logical sequence from what has preceded it, the starting-point of the whole being the geographical description of the Nile valley. Mr. White has a striking and original way of presenting his facts, and his volume is decidedly suggestive, while, apart from its more definite object, it is of value as presenting a clear view of recent Egyptian history, its administrative system, and the progress it has made under British control. In the discussion of the physical factors, Mr. White's central idea is the organic unity of the Nile valley and the consequent need that it should be under one political control.† He is, perhaps, inclined to lay too much stress on the isolation of the Nile valley from the rest of the continent, and to overlook the differences which exist between its component parts, which, but for the connection supplied by the river itself, could hardly have been brought into close relation on purely natural grounds. After dealing with Egypt proper, the author gives an interesting chapter on the Sudan, the section dealing with the "title-deeds of the Nile valley" being useful as bringing together the various international agreements on which the Anglo-Egyptian rights depend. Mr. White urges the importance of fixing a definitive frontier with Abyssinia, the absence of which is the one weak point in our settlement of pending questions. He regards the Lybian desert as placed within the Egyptian sphere by the recent agreement with France, but it is to be observed that Article III. of the Declaration merely conceded the French claims up to a certain line in this direction, without saying anything of the status of the country beyond it, which most naturally forms the *Hinterland* of Tripoli.‡ Again, the dissatisfaction felt in Italy was not so much due, as Mr. White supposes, to the idea that Tripoli became a French sphere, as

* 'The Expansion of Egypt under Anglo-Egyptian Condominium.' By Arthur Silva White. London: Methuen. 1899.

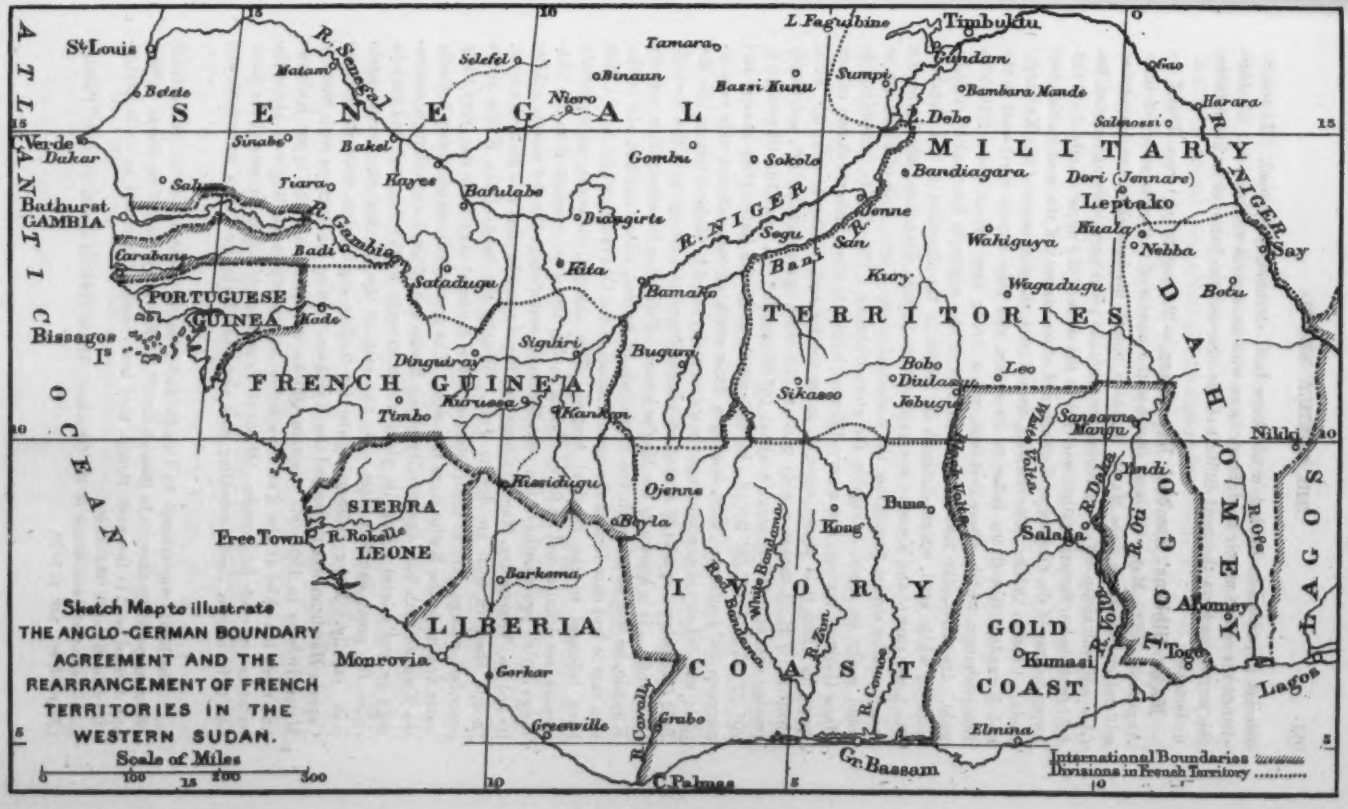
† Mr. White makes a curious slip in stating that the Nile basin would contain the area of a hundred British isles. For a hundred, ten should of course be read.

‡ The trade route from Bengazi to Wadai renders this otherwise valueless tract of some importance to the possessor of Tripoli.

that Tibesti, naturally another part of Tripoli's *Hinterland*, was assigned to France. The work contains some useful maps, by Bartholomew, of the Nile basin. In that showing political data, the whole British and Egyptian territory from Alexandria to Mombasa is divided into four areas, according to the four grades of British domination spoken of in the text. The reason for the severance from the Sudan by the parallel passing through Fashoda, of the Bahr-el-Ghazal, etc., as a "British sphere of influence," is not evident, as this is in accordance neither with the terms of the Anglo-Egyptian agreement of January, 1899, nor with the fact that Egyptian stations have already been re-established south of that line. The map showing zones of vegetation is misleading in one or two points. Thus Uganda, with its abundant vegetation, is shown of the same tint as the arid plains of Somaliland, while the coast lands of British East Africa are supposed to be covered with dense forests comparable to those of the Congo basin.

Reorganization of French West Africa.—By a decree of the French Colonial Minister, dated October 17, 1899, the French possessions in West Africa have been placed under a new organization, which considerably modifies the distribution of territory between the various provinces. The reason given is the difficulty which has been experienced in controlling the operations in the far interior—on the Middle Niger—from so distant a centre as Kayes, the capital of Senegal. The Middle Niger region, including the greater part of the area within the bend of the river, is therefore placed under a separate military administration, while the western portion of the old Sudan province is united with that of Senegal to form a single administrative division, which reaches eastward to Lake Debu. French Guinea, the Ivory Coast, and Dahome remain, broadly speaking, within the same limits as formerly, the Ivory Coast extending roughly to 10° N., and Dahome a little north of the latitude of Say. The approximate boundaries of the new divisions are shown on the opposite map, which also illustrates the territorial arrangements between Great Britain and Germany in the same region. They are taken from a map published in the *Bulletin du Comité de l'Afrique Française*, and reproduced in the *Politique Coloniale* for November 14.

Baron von Grünau's Visit to Siwa.—During the winter of 1898–99 a visit to the Siwa oasis was made by Baron von Grünau, who gives a short account of his journey in the *Zeitschrift* of the Berlin Geographical Society (1899, No. 3). Between the Natron lakes and Moghara the German traveller seems to have taken a route not often followed across the plateau, by which the length of the journey was reduced by a day. The ground here entailed a succession of ascents and descents over a rocky surface, but the differences in elevation were but slight. Baron von Grünau made a compass survey of the route, and was able to correct some slight errors in the maps. He also carried out a regular series of meteorological observations, as well as determinations of the temperature of the water of wells. In Siwa he took measurements of some of the ruins, but does not seem to have added much to the information collected by Mr. Silva White. He seems to have been incorrectly informed that Mr. White did not visit Aghormi, of which a photograph is given in that traveller's book. Possibly, however, the particular ruins which he claims to have discovered were not seen by Mr. White. The temperature of the famous "fountain of the sun," near the temple of Jupiter Ammon, was repeatedly taken, at various hours of the day, and the same result (31° C. or 87·8° Fahr.) obtained in each case. The popular idea that it is cooler at midday and warmer in the evening, is thus due only to the divergence of the temperature from that of the outer air. Baron von Grünau met with a friendly reception from the sheiks, even from the representative of the Senussi, but any


ATLANTIC OCEAN
St Louis
R. Senegal
Matam
Selefel
Tamara
L. Faguibine
Timbuktu
Gundam
Bandiagara
Bambara Mande
Harara
Salamossi
Niaro
Binaun
Bassi Kunu
Sumpi
L. Debo
SENEGAL
Verde
Dakar
Sirabo
Bakel
Gombu
Sokolo
MILITARY
Dori (Jennare)
Leptako
Bathurst
GAMBIA
Kayes
Bafulabe
Diangirte
R. NIGER
Senne
Segu
San
Kuala
Nebba
Say
Carabane
Badi
R. Gambia
Kita
Bani
Kury
Wahiguya
Wagadugu
Bobo
Diulasso
Leo
Bolu
PORTUGUESE
GUINEA
Bissagos Is
Sataduga
Bamako
TERRITORIES
DAHOMEY
Dinguiray
Sighiri
Bugum
FRENCH GUINEA
Timbo
Kuruesa
Kankan
Sikasso
Jebugu
Sansanne Manga
Nikki
Hamdallahi
Ojenne
Kissidugu
SIERRA
LEONE
Free Town
R. Rokelle
Bonla
Buna
Kong
Salaga
Yendi
R. Oti
R. Daka
R. Volta
Barkoma
IVORY
COAST
GOLD
COAST
Abomey
Kumasi
Togo
Lagos
LIBERIA
Monrovia
Gorkar
Greenville
Grabo
C. Palmas
Gr. Bassam
Elmina
R. Comoe
R. Zan
White Bandama
R. Bandama
R. Cavally
Sketch Map to illustrate
THE ANGLO-GERMAN BOUNDARY
AGREEMENT AND THE
REARRANGEMENT OF FRENCH
TERRITORIES IN THE
WESTERN SUDAN.
Scale of Miles
0 100 15 200 300
International Boundaries
Divisions in French Territory

attempt to proceed to Jarabub would have been strenuously opposed. He accomplished the return march in eighteen days without serious mishaps, but considers the journey to Siwa the most difficult of the nine caravan journeys he has hitherto undertaken.

Major Gibbons' Zambezi Expedition.—Writing to us from Lialui on August 31, 1899, Major Gibbons sketches the results of the explorations of himself and his colleagues since March, in which month his last letter was despatched (*Journal*, vol. xiv. p. 93). In accordance with the plans previously announced, the field first chosen for exploration was that to the west of the upper Zambezi, on the upper courses of the Okavango, Kwando and other streams of the western Zambezi basin. Captain Quicke, after reaching, from Lialui, the confluence of the Kubangui and Kwando, followed the latter to its source, and then struck north-east to the Lungwebungu, which, where first seen, was a strong deep stream about 200 yards wide. Its valley, like that of other streams of the region, is bounded by undulations of white sand, which diminish in height in the direction of the Zambezi. The lower part of the Kwando was explored by Captain Hamilton, who found it a much smaller stream than either the Kubangui or the Kwito, both of which are, or could easily be made, navigable for stern-wheelers. The Kwito, according to Major Gibbons' survey, has a very different course to that hitherto shown on our maps, on which it is placed some 25 miles too far east. After crossing 19° E. in about 15° 5′ S., it makes a wide curve to the west, again crossing 19°, and finally passing east of that line only in about 16° 65′ south.* It joins the Okavango in 20° 27′ E. and 17° 58′ 30″ S., beyond which point the latter river crosses and recrosses 18° south, and then, flowing a little south of east, enters a wide swamp-plain without any of the windings shown on many maps.† Major Gibbons, like Mr. Reid (see below), speaks of a channel connecting the Okavango with the Kwando (Linyanti). It is known as the Mag'wekwana. Following its course from near the Kwando, he was struck with the magnitude of its bed, which inclined him to the idea that it had once formed the main channel of the Okavango, which would then have belonged to the Zambezi system. The channel, however, subsequently became less definite, and he found that it merely forms an overflow from the Okavango during two months of the year, becoming waterless in the dry season. After its bed had become dry, Major Gibbons still found water in pans well above its level, though these in turn are dry in July. Within the bend of the Kwito above described, a large number of tributaries of the Kwando take their rise, very little water flowing to the Kwito from this side. The ground falls considerably towards the Kwando both from the vicinity of the Kwito and of the Lungwebungu, enclosing a generally level triangular plain which extends to the Zambezi, and may be called the great Zambezi plain. On the east of the Zambezi the ground again rises rapidly. Major Gibbons' plans for further exploration were as follows: Captain Hamilton was to descend the Kafukwe, joining his surveys with those of Major Gibbons in 1895–96. Captain Quicke was to ascend the upper Kafukwe and meet his chief at the Kabompo source, afterwards proceeding west along the watershed *en route* for Loanda. Major Gibbons himself hoped to ascend the Zambezi to its source, then proceeding east along the Kafukwe-Congo watershed, and

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* The Kwito was crossed by Capello and Ivens in about 15° 45′ S., its longitude being supposed by them to be then about 19° 35′ E. They showed its course without any decided bend to the west, though they were correctly informed as to its navigability down to the Okavango.

† As to the lower course of the Okavango, Major Gibbons agrees with Dr. Passage (*Journal*, vol. xiv. p. 311).

making his way to Tanganyika. Thence he will, if possible, make for the Nile and Khartum. His proceedings have been somewhat hampered by the impossibility of obtaining supplies from the lower river, owing to the unfortunate death of Mr. Muller and the retirement through ill health of Mr. Weller.

Survey of the Linyanti River by Mr. Percy Reid.—Mr. Percy Reid, whose explorations in the Barotse country in 1895–96 are well known to our readers, writes to us from Kazungula, under date September 17, announcing his return to that place from a trip round the marshes of the Linyanti river (Chobe of Livingstone), as far as Maini's, placed in our maps in about 23° E. Mr. Reid had been able to make a fair number of astronomical observations, and had fixed the position of Maini's and of the Sunta river (the arm which diverges to the south) by occultations. He hoped also to fix the position of Kazungula (opposite the mouth of the Linyanti) in the same way. An interesting discovery is that of the waterway connecting the Okavango marshes with those of the Chobe, which has long been reported to exist, though the fact has been doubted.* Mr. Reid has paid much attention to the mysterious subject of the rise of the Linyanti at the height of the dry season, to which attention was first, we believe, called by Mr. Selous (*Proc. R.G.S.*, N.S., vol. iii. p. 171), and we may hope that his observations will throw light on the problem. Mr. Reid says that the river rises *twice* in the year. Mr. Selous found the flood-water at its highest in September, while Dr. Bradshaw (*ibid.*, p. 212), who seems to have been in the country at all times of the year, says that the rise commenced in January, and was at its full height in March, falling till January again. It would almost seem as if the *régime* of the floods varied from year to year, and this is in some measure borne out by Mr. Selous' statement that between 1874 and 1879 the overflow seemed to be growing less year by year. Mr. Arnot, who crossed the headstreams of the river in 1884, accounted for its rise in the dry season by the porous nature of the ground near its sources, which was said to absorb the rainfall until the close of the wet season (*Proceedings*, N.S., vol. xi. p. 69).

Fluctuations in the Level of Tanganyika.—The *Mouvement Géographique* for October 22 last (No. 43, 1899) prints an extract from a letter from Père Daull, missionary at Karema, relative to recent changes in the level of Lake Tanganyika. Since 1879, the writer says, the lake has fallen at least 26 feet (8 metres), there being now more than a kilometre of cultivated land between the shore-line and the low hills near Karema, which the water reached a few years ago. This does not mean, he says, that the lake is in course of disappearance, but merely that it has retreated within its natural bed, its former high level being due to the blocking of the outlet. It now remains stationary. Père Daull also gives some particulars respecting the present state of Ujiji, or rather of the chief centre of that district. Arab influence has entirely declined, most of the traders having left for the coast. A Greek trader now occupies the house of the former English mission. The Germans, under whose rule there is complete security for Europeans, are introducing the rupee as the official medium of exchange.

Surveys by Captain Ashburnham in Buddu and Ankoli.—Cap'ain Ashburnham, who before starting for Uganda took some lessons in surveying under the Society's instructor, writes to Mr. Coles from Buddu, giving an account of his surveys in that country, with sketch-maps. The chief geographical result has been the first correct delineation of Lake Kachera, which, though long known to

* Dr. Aurel Schulz found that a considerable stream, which he concluded to be a branch of the Okavango, entered the Linyanti from the west. His idea was confirmed by native accounts.

exist, has hitherto been incorrectly shown on the maps. The lake seems to have been first visited by Lieut. Hobart (*Journal*, vol. xii. p. 189), who, however, saw a part of it only, and considered this to be distinct from the lake previously shown on the maps from native accounts. Captain Ashburnham has traced its shores without losing sight of it for more than an hour at a time, and has found that there is only one lake, split up into a number of narrow arms. The greatest length of the lake—about 25 miles according to Captain Ashburnham's sketch—is from west to east, but there is a long narrow arm running north for about 12 miles to the neighbourhood of Kabula (on Lugard's route of 1891–92). The Ruezi river enters the lake at the west end, while the Kivale, known lower down as the Bukora, flows out at the east, entering the Victoria Nyanza a little north of the mouth of the Kagera, with which river it has no connection, though erroneously shown as a tributary on some maps.* The name Kachera is known to all the neighbouring tribes, though each separate inlet (of which there are nearly a dozen) seems to have its own local name. A depression among the hills to the south-west, forming the continuation of one of the arms of the lake, constitutes the boundary between Koki and Ankoli, and another natural trough, continuing the line of the northern arm, separates the latter from Buddu. Neither the Ruezi nor the Bukora are navigable, though the Bukora is deep even in the dry weather, but, like a great part of the lake, is choked with papyrus. There are no crocodiles in either, though they swarm in the Kagera. The district of Sango, south of the Bukora mouth, is densely cultivated, but a forest of large timber stretches to the south and south-west of this. Captain Ashburnham's observations for latitude confirm Lieut. Hobart's statement that the German operations have overstepped the boundary into the British sphere. He has had a good deal of trouble with the rebels, but thinks that their power is now broken.

AMERICA.

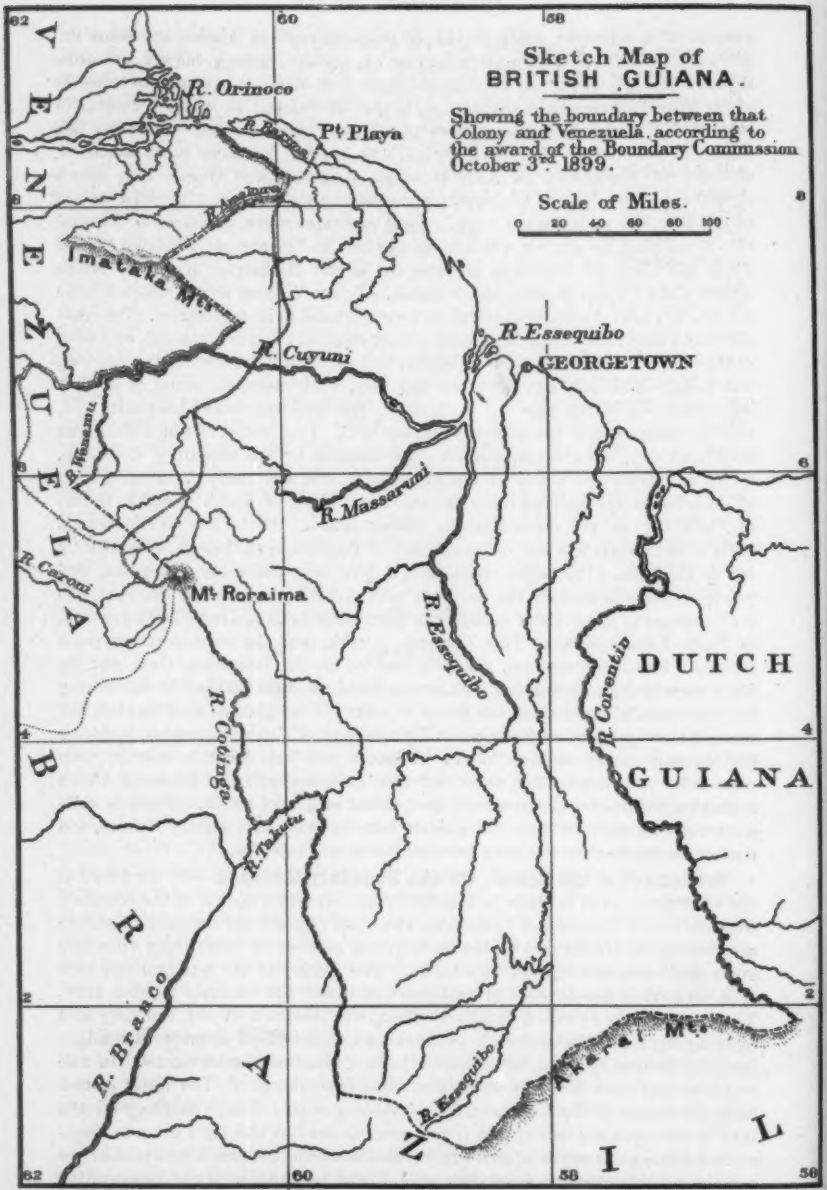
Forest and Prairie in Nebraska.—A short paper on recent changes in the extent of forest-land on the Nebraska plains appears in *Science* for November 24 last, having been read by Mr. C. E. Bessey at the last meeting of the American Association for the Advancement of Science. Two years before, the same author had shown reason for believing that the pines of Western Nebraska are advancing eastward where destruction by fire or cattle is prevented, and where cutting does not proceed too rapidly. He now brings forward evidence from Eastern Nebraska, which, he says, is still more conclusive that tree areas are there advancing with a good deal of rapidity. He has found that, in travelling up-stream and passing out to the side branches, the trees are invariably smaller and younger, it being a very rare occurrence to find large trees near the upper end of a forest belt. This alone would hardly be conclusive, but it is supported by the statements of old settlers, who invariably tell of an advance of trees up the valleys, sometimes a mile or more, while the width of the timber belts on the streams has also greatly increased. The keeping out of fire seems the general cause of the spread of the trees.

The Harriman Expedition to Alaska.—An account of the expedition to Alaska last summer, organized by Mr. E. H. Harriman, is given by Mr. Henry Gannett, of the U.S. Geological Survey, in the *Bulletin* of the American Geographical Society, vol. xxxi., No. 4, 1899. This expedition was planned for the

* The Ruezi ("Rwizi"), the lake, and the Kivali ("Kiware") were shown in correct relation in Stanley's map of 1878, though the latter river was made to join the Kagera. The name of the lake was not then known, but was correctly given in Mr. Ravenstein's map illustrating Captain Lugard's journeys.

purpose of a scientific study of the little-known coast of Alaska, and some important contributions were made to geography, geology, zoology, botany, and other departments of science. As no extended stops were made, it was only possible to make limited surveys in localities of particular interest and to measure heights of mountains. Many glaciers were surveyed and their fronts located. The party left Seattle in the steamer *Geo. W. Elder* on May 31, and proceeded north-westward, touching at Metlakatla, on Annette island, Skagway, and Glacier bay, where several days were devoted to mapping and studying the glaciers. At Sitka several days were given to biological work. Some important work was done at Yakutat bay in mapping the glaciers which discharge here and in the neighbouring Russell Fiord, including the Hubbard, probably the largest discharging glacier in North America, the Dalton, Hidden, and Nunatak. Prince William sound, which is little known, was next visited, and several days were devoted to its exploration. The coast was found incorrectly mapped in many places, especially on the north and west sides of the sound. A fiord, 15 miles in length, and containing five discharging glaciers, was found, which does not appear on any map, while elsewhere scores of glaciers were discovered which were not on record. The fiord was named Harriman fiord, and was mapped, with the glaciers tributary to it. Port Wells, of which Harriman fiord is an arm, was also mapped. A glacier, named by the expedition Columbia, which discharges into a bay of the same name, was also mapped. From Prince William sound the ship proceeded to the north shore of Shelik of strait, thence to Uyak bay, on the north shore of Kadiak island. On the way to Unalaska a party of naturalists was left on Popof, one of the Shumagin islands, others being left at Unalaska. Proceeding northward, a brief stay was made at Bogoslof, two young volcanic islands in the southern part of Bering sea, and at St. Paul, the northernmost of the Pribilof islands, the party afterwards arriving at Plover bay, in North-Eastern Siberia. Port Clarence, Alaska, was the most northern point reached. Starting southward, the ship touched at St. Lawrence, Hall, and St. Matthew islands, in Bering Sea, which were found thronged with sea-birds. During this two months' exploration, the fronts of twenty-three glaciers were located, and most of these glaciers were mapped. The heights of many mountains, including the volcanic cones on the Alaska peninsula and the Aleutian islands, were measured. A prominent fact connected with the coast region of Southern Alaska is that its features are almost wholly the product of glacial action. There is sufficient evidence to show that the glaciers have in past times greatly receded, and that on the whole they are, with few exceptions, still receding.

Settlement of the British Guiana Boundary Question.—By the award of the arbitrators, given in Paris on October 3, the disputed question of the boundary between British Guiana and Venezuela, which has engaged the attention of statesmen during the greater part of the century, and reached an acute stage some four years ago, has at last received its solution. The history of the question has been fully set forth in the *Journal* in past years, and need not be again touched upon. The result of the award is, broadly speaking, the adoption of the boundary laid down by Sir Robert Schomburgk as marking the extent of country that might justly be claimed by Great Britain on the basis of historical considerations. In two localities only does the new line differ from Schomburgk's. The latter started from the mouth of the Amakuru, thus including within British territory all the land to the north and east of that river; whereas the line now fixed gives to Venezuela the triangular section of territory included between the lower course of the river and the sea—a concession more than once offered by this country in consideration of the importance attached by our neighbour to the complete possession of the territory on both sides of the Orinoco. The second deviation from the Schomburgk


Sketch Map of
BRITISH GUIANA.
Showing the boundary between that Colony and Venezuela, according to the award of the Boundary Commission October 3rd 1899.
Scale of Miles.
0 20 40 60 80 100
62
60
58
56
8
6
4
2
R. Orinoco
Pt Playa
R. Barima
R. Amacuro
Imataka Mts
R. Cuyuni
R. Essequibo
GEORGETOWN
R. Massaruni
R. Caroni
Mt Roraima
R. Essequibo
R. Corentin
DUTCH
GUIANA
R. Cotinga
R. Takutu
R. Branco
R. Essequibo
Akarai Mts
VENEZUELA
BRAZIL
Original Schomburgk line
Extension of the Schomburgk line
Boundary settlement, Oct. 3. 1899.

line occurs to the south of the Kuyuni, a tributary of the latter—the Wenamu—being chosen as the boundary instead of the upper course of the Kuyuni itself. The intervening district is inhabited chiefly by Indian tribes, but it includes the British Yuruan post, which formed the subject of special difficulties between the two governments a few years ago. It was claimed on behalf of Great Britain that a Dutch post existed here in former times. That a Dutch fort existed in the seventeenth century near the mouth of the Barima, in the territory now made over to Venezuela, seems not to admit of doubt. Here, too, British stations have existed during recent years, and some agricultural settlements have been made, which are now transferred to Venezuela. All the gold-fields, however, in the disputed area, with the exception of that on the Yuruari beyond the Schomburgk line, remain within the territory of the colony. The accompanying map shows the new boundary in detail. It starts from the coast at Point Playa, and runs thence to the junction of the Barima with the Mururuma; then up the latter to its source, and across to the junction of the Haiowa with the Amakuru; up the latter to its source, and south-west along the spur of the Imataka range to a point opposite the source of the Barima, where it turns south-east, following the main Imataka range to the source of the Akaribisi; down the latter to the Kuyuni, and along the northern bank of this river to the mouth of the Wenamu; then up the Wenamu to its westernmost source, and thence direct to the summit of Mount Roraima. Beyond this point the line is subject to an arrangement with Brazil, but is provisionally fixed by the lines of the Kotinga and Takutu rivers and the Akarai mountains. It is matter for congratulation that a question which has so long affected the prosperity of British Guiana is at last satisfactorily settled, and it may be hoped that the development of the colony will now proceed without hindrance. It should be mentioned that the award provides for freedom of navigation and equality of treatment to the goods of both nations on the Barima and Amakuru rivers.

AUSTRALASIA AND OCEANIC ISLANDS.

The Dutch Discoveries of Australia.*—Prof. J. E. Heeres, whose valuable work on Tasman's life and voyages was noticed in the *Journal* early in the present year, has rendered another service to historical geography by editing a complete series of documents bearing on the Dutch voyages to Australia from 1606 to 1765. Prof. Heeres laments the general ignorance which prevails on the subject of these voyages, an ignorance due largely to the rarity of a working acquaintance with the Dutch language on the part of foreign students, though even in Holland the story of early discovery is insufficiently known. Mr. Major's collection of documents bearing on the subject is, though far from complete, useful so far as it goes, and it is therefore unnecessary, Prof. Heeres thinks, to reprint at length those given by him. But the Hague archives contain a large amount of hitherto unpublished matter, which is now given to the world both in Dutch and English, thus supplying students for the first time with all the available information respecting the first authenticated voyages to the fifth great land-area of the world. The *data* respecting some of the discoveries are very meagre, though in certain cases the fortunate existence of charts embodying the results of the voyages supplies satisfactory evidence that they were made. Many of these charts are reproduced by Prof. Heeres, the most interesting being perhaps those of Hessel Gerritsz of 1618 (subsequently

* 'The Part borne by the Dutch in the Discovery of Australia, 1606–1765.' By J. E. Heeres, LL D. Published by the Royal Dutch Geographical Society in commemoration of the twenty-fifth anniversary of its foundation. London: Luzac & Co. Leiden: Brill. 1899. [In Dutch and English.]

revised) and 1627, which record the discovery of Eendrachtsland and other parts of Western Australia. The first use, apparently, of the name Eendrachtsland to designate the land discovered by Dirk Hartogszoon in the *Eendracht* in 1616 is to be found in a marginal note, added by an official of the East India Company to a letter reporting the result of the voyage of the *Mauritius* in 1618. A large map by Isaac De Graaf is valuable as a general record of the discoveries of the Dutch in the seventeenth century, and also as showing the results of De Vlamingh's voyage in 1696–97. Among the documents perhaps the most valuable are the journal kept by Jan Carstensz on his voyage of 1623 to the gulf of Carpentaria with the Pera and Arnhem, and the various papers relating to the voyage of Pool and Pieterszoon in 1636. Other documents deal with less-known voyages, *e.g.* that of Jan Van der Wall to the north-west coast in 1678, for which the only authority seems to be a chart showing the results of the survey. While allowing that the Dutch discoveries in the west were the result of accident, Prof. Heeres points out that those in the north were the outcome of a systematic endeavour on the part of the Dutch officials to extend the sphere of their operations.

Report by the Surveyor-General of New Zealand for 1898–99.—The recently issued report of the New Zealand Department of Lands and Survey contains an unusual amount of interesting matter relating to the development of the resources of the colony as well as to the present position of its surveys. It is illustrated by a large number of maps and views of scenery, etc. With regard to the trigonometrical and topographical surveys, Mr. Percy Smith reports that the largest area under triangulation during the year lies in the centre of the north island, around the mountain groups of Ruapehu, Tongariro, Kaimanawa, etc., forming the connecting link between the triangulation of Aukland, Wellington, and Hawke's bay. The work has been carried out under the direction of Mr. J. H. Lowe, and the final results are looked forward to with considerable interest. Existing triangulation in Taranaki has been extended, and in Nelson a large area among the western mountains has been surveyed. The preliminary results seem to show that the west coast south of Cape Farewell is slightly out of position on the charts. The surveys in Marlborough, around the Kaikoura mountains, will furnish data respecting a district very imperfectly mapped at present. An appendix to the report (No. 11) gives the account of a journey of exploration made by Mr. W. Y. H. Hall in the mountainous region west of Lake Te Anau, with sketch-map. Mr. Hall, with a native companion, started from the head of the south fiord of the lake, and spent three days without tent or blanket exploring the valleys beyond. Near the head of the fiord a stream (named by Mr. Hall "Gorge Burn") runs in from the west, bounded on the south by mountains 5000 to 6000 feet high. Ascending its valley, Mr. Hall discovered a series of lakes, and, crossing a spur to the north, came upon another series (also drained towards Gorge Burn), the largest of which—about 3 miles long according to the map—lay right under the West Coast range. Mr. Hall's companion climbed Forden peak, whence he looked down to Bradshaw sound, an inlet off the west coast. An attempt to descend to the lakes of the Esk Burn valley to the north proved impossible, owing to the precipices which surround them, and the return to the Gorge Burn valley had likewise to be made down awkward precipices. Other appendices deal with forestry, with the sanctuaries for wild animals which have been established, and with the "Hermitage" and other works for the opening of the Mount Cook district to tourists, as well as to such subjects as the progress of settlement and road-making. The "Sanctuaries" alluded to include Little Barrier island, the avi-fauna of which embraces species nearly extinct on the mainland; the Paraparaumu reserve, devoted especially to the rearing of game-birds and deer; and Resolution island, on which and neighbouring

islands Mr. Henry, the curator, succeeded in placing some additional species of birds during the year. Mr. Henry gives a sketch-map of the maze of islands in Dusky sound, south of Anchor island; he says that the "Sealer's cove" of our maps, on the south side of the latter, is the inlet called by Cook "Luncheon cove," although the latter name is now applied to a spot a mile further west. The report also includes a photograph and description of the rare bird *Notornis Mantelli*, of which the fourth specimen only was discovered near Lake Te Anau in 1898. This bird, which forms a distinct genus of *Rallidæ*, is the prototype of a well-known genus of swamp-hens. The last specimen, probably immature, stood 20 inches high.

The British Solomon Islands.—The report for 1898–99 of Mr. Woodford, Resident Commissioner for the British Solomon islands, has lately been issued by the Colonial Office (No. 275). Including the small groups added in 1897–98, the protectorate now extends (apart from the islands just ceded by Germany) for 900 miles from N.N.W. to S.S.E., but the new islands are at present of small importance as regards trade. The white residents in the protectorate now number fifty to sixty, and the prospects of trade seem to be good, owing to the introduction of sun- in place of smoke-drying of copra, and the commencement of diving operations for the large gold-tipped pearl-shell. Tobacco is the principal export, but the demand for Sydney-built boats among the natives is increasing. The area of land under cultivation by white residents (chiefly for coconuts) is steadily increasing, and favourable reports have been received from two experimental coffee plantations on the Guadalcanar. The report includes tables of rainfall observations, which give the total amount for 1898 at 147·39 inches, a fall having taken place on two hundred and forty days, the smallest number of rainy days in any one month (June) being fifteen. The account is also given of an interesting expedition made by Mr. Woodford, accompanied by Mr. Svensen, to the interior mountains of Guadalcanar, of which Mount Lammas, seen from the south coast, has been generally supposed to be the highest. The party landed on the shore of Wanderer bay, then proceeding eastward across the spur which terminates at Cape Hunter. Hence a view was obtained of a straight pebble beach strewn with the trunks of enormous trees, evidently brought down by the Ithina river in flood. This appears to be the largest river on the south coast, draining the whole district visited by Mr. Woodford. The volume of water must, after heavy rain, be enormous. Crossing this stream, the explorers struck into the bush after reaching the deserted village of Bolonda. An ascent to 1600 feet was followed by a descent to the Kolondoma, a tributary of the Ithima, running west through a rocky gorge. A steep rocky track led into the region of ferns and moss, and at 2700 feet quarters for the night were found in a native hut, whence a good view of the country was obtained. Immediately in front, but far below, was the gorge of the Teremalenga, another tributary of the Ithina, coming from Mount Popomanasiu by a fine fall of perhaps 400 feet. From Mount Legombi on the right a horseshoe of mountains closed the view as far as the north-east. On the third day, after a descent of 1100 feet to the rock-encumbered Teremalenga river, the ascent was resumed through a region of daily rain, where trees and ground were thickly covered with moss. On the fourth the party passed over the summit of Bulumarau to that of Popomanasiu (nearly 6000 feet). The latter falls 3000 feet to the valley of the Ithina, there being no saddle connecting it with the great Kavo range, which is undoubtedly the highest in the island. Provisions now running short, it was impossible to proceed farther, but the experience gained will be of use for any future attempt. Mr. Woodford made interesting notes on the botany of the country, the conditions between 4000 and 6000 feet being found much the same as on the mountains of New Guinea.

The South Sea Islands and European Enterprise.*—Count Pfeil's recent work on the German possessions in the Western Pacific deserves the careful attention of all who are interested in the future of European dealings with less civilized races. Although the book has something to say regarding the natural features of New Guinea and the neighbouring archipelagoes, its central idea is the discussion of the problems which affect the future prosperity and development of the German Pacific, with especial regard to the mutual relations of the white and coloured inhabitants; and the author's views are both practical and well-considered. After an introductory chapter, in which he sums up with judicious conciseness the most striking physical characteristics of the countries in question, with a sketch of their recent history, he turns to the consideration of the native tribes, which, in spite of the impossibility of extended travel during the period of his stay in the islands, he was able to study with some thoroughness from their concourse to the trading ports and labour-stations. He regards them throughout rather from a psychological than an ethnographical standpoint, deducing their mental and moral characteristics from a preliminary view of their manners and customs. Chapters I. to III. treat in unusual detail of these subjects, the life-history of a "Kanaka" from birth to death being vividly sketched. The fourth chapter deals with the nature of their habitat, and especially the volcanic agencies there exhibited, while the fifth takes up the possibilities of economic development. In this connection Count Pfeil wisely urges the great importance of obtaining by systematic effort a more thorough knowledge of the conditions of the country, pointing out how much the want of such knowledge may hinder progress. As regards the future relations of the whites with the natives, he dismisses as chimerical the idea that the two races might live together on equal terms, but, on the other hand, rejects the pessimistic views of those who hold that the natives must eventually succumb. The great reserve of the character of the natives and their slowness to adopt European ideas and methods are the great hindrances to their acceptance of the position of labourers under European control, while the rooted idea, so often prevalent, that the white man's stay is only temporary, tends in the same direction. It is among the more warlike tribes, which are also the most intelligent, that a future labour-supply will, in Count Pfeil's opinion, most probably be obtained; but hostile encounters can hardly be avoided before this event is reached. Meanwhile the immediate wants of the colonies might be supplied by the introduction of Chinese coolies. Plantation products must form the staple resource of the possession, and for these New Pomerania, where the greatest progress has already been made, seems the most promising portion. German New Guinea as a whole presents a less favourable picture. The last chapter contains some interesting experiences of travel, though the author has elsewhere carefully avoided introducing the personal element.

POLAR REGIONS.

Exploration in the Siberian Sea.—A sum of £5400 has been inscribed in the Budget of the Russian Ministry for the equipment next summer of an Arctic Hydrographic Expedition to the northern shores of Siberia, with the view of exploring in detail the northern route to the mouths of the Ob and the Yenisei.

GENERAL.

The Anglo-German Agreement.†—The latest international agreement with regard to the delimitation of colonial possessions settles in a satisfactory manner

* 'Studien und Beobachtungen aus der Südsee.' Von Joachim Graf Pfeil. Brunswick: Vieweg. 1899.

† Map showing West African arrangement, p. 63.

the last important points outstanding between Germany and this country. It has been arrived at by mutual concessions, Great Britain waiving her undoubted rights in the Samoan archipelago in return for important renunciation of claims in other parts of the world by Germany. The Samoan islands of Savaii and Upolu are made over absolutely to Germany, who thus secures a much-desired position on the ocean routes from San Francisco and Vancouver to New Zealand and Australia, and from the western end of any future American inter-oceanic canal to her possessions in New Guinea and neighbouring seas. The third important island, Tutuila, is reserved for the United States. Great Britain obtains in exchange the relinquishment by Germany of all claims to a coaling-station in the Tonga group, important to Great Britain by reason of its nearness to Fiji, and the cession of the two islands of Choiseul and Isabel in the Solomon group, which, with Bougainville and Buka (still German), had fallen to Germany in the partition of the group in 1886. The British possessions in this part of the Pacific are thus rounded off in a more satisfactory way than formerly. In West Africa an important settlement has been arrived at with respect to the "Neutral Zone" established in 1888 in the region behind the Gold Coast. This, together with the area to the north between 10° and 11° N., is now divided between Great Britain and Germany in such a way that the former secures possession of the natural *Hinterland* of the Gold Coast in the Upper Volta basin, as far as the commencement of French territory. From the point on the Volta where the neutral zone began, the new boundary is to follow the Daka tributary of that stream to 9°, beyond which it is to run north in a line to be demarcated by a mixed commission, but which is to be so chosen that the territories of Mamprusi and Gambaga fall to Great Britain, and those of Yendi and Chakosi to Germany.* By this arrangement the two important trade centres of Salaga and Yendi, within the former neutral zone, fall, the first to Great Britain, the second to Germany. Gambaga, to which the latter had laid claim, though a treaty with the ruler had been made in 1894 by British agents, lies in the western portion of the contested territory north of the neutral zone, while Chakosi (Yakoshi) is the name of the district further east, which contains the town of Sansanne Mangu, where the Germans already have a station. Information respecting the region in question is principally to be found in the reports of German officers in the *Mitteilungen aus den Deutschen Schutzgebieten*, the results of journeys by British officers having, unfortunately, been rarely given to the world. Captain Lonsdale's journey to Salaga and Yendi in 1881—the first accomplished by a European—was, however, described in the Parliamentary Report on the Gold Coast for 1882. Lieut. von François' journeys to Yendi, Gambaga, etc., in 1888–89 are described in the first two volumes of the German publication above alluded to; and those of Captain Binger, our medallist, who traversed the Upper Volta region on his great journey across the Western Sudan (1887–89), in that traveller's book, 'Du Niger au Golfe de Guinée.' The best map of the region is that by P. Sprigade, on the scale of 1 : 1,000,000, given with the *Mitteilungen* for 1898 (part 4). Finally, it must be mentioned that the agreement includes the conditional abandonment by Germany of extra-territorial rights in Zanzibar. The map on p. 63 shows the new boundary in West Africa so far as it can be laid down previous to delimitation on the spot.

New System for the Transcription of Geographical Names.†—The latest contribution to the vexed question of geographical orthography is a memoir by

* With our present knowledge, the boundary cannot be correctly shown beyond 9° N.

† Méthode de Transcription Rationelle Générale des noms Géographiques. Par Christian Garnier. Paris: Leroux. 1899.

the late Christian Garnier, which recently gained the Volney prize of the French Institute, with special commendation. The author was a young French *savant*, whose attention was directed to the subject during the London meeting of the International Geographical Congress, and who took up the idea of supplying an improved general system of orthography with such enthusiasm, that early last year, in spite of failing health, he had completed the laborious linguistic and other studies necessary to the working out of a system based on thoroughly scientific principles. M. Garnier's memoir lays down with great clearness the *desiderata* for a really rational general system of transcription, and there is no doubt that, granting such a system to be itself desirable, his work marks an advance on previous attempts in the same direction, simplicity having been aimed at as well as comprehensiveness. The author shows the disadvantages of both strictly orthographic and phonetic methods, and his system is a combination of the two. After a chapter on general principles, he examines in turn the principal alphabets and languages of the world, with a view to gaining a clear idea of the sounds to be represented, and then proceeds to explain his system in detail. His alphabet consists (1) of fundamental letters—those of the complete Latin alphabet; (2) of signs indicating aspirations, clicks, and "tones," or vocal modulations of vowels; (3) of accents modifying the sounds of the fundamental letters; (4) of supplementary letters; (5) of graphic conventions. A few examples only of the use of the modifying signs can be given. On the analogy of the Croatian *c* the sign ˇ is used with *c*, *s*, and *z* to give the sounds of the English *ch*, *sh*, and the French *j*. The point below the letter denotes, according to established custom, cerebral consonants, while the comma in the same position nasalizes the *n*. The sign ·· modifies the sound of vowels (*ö* representing the French *eu*), and when used with *d* and *t*, gives the sound of the soft and hard *th* in English. Whatever advantages the method may possess, it is extremely doubtful whether any such universal system can prove serviceable in practice. Apart from the large number of symbols required, it must necessarily have the disadvantage, that even the fundamental letters agree in value with the established usage in no single country, while a confusion must always arise from the uncertainty whether the universal or particular method is employed in any given case. The adoption of a limited number of systems, suited to the usage of the principal languages of Europe, would involve no greater confusion than the existence of the languages themselves necessitates, and would even in certain cases facilitate correct pronunciation, by the means for comparison thus supplied.

OBITUARY.

Sir Rawson William Rawson, K.C.M.G., C.B.

By the death, on November 20, of Sir Rawson Rawson, at the advanced age of eighty-eight years, the Society has lost one of its oldest and most valued members. Sir Rawson joined its ranks as far back as 1838, there being now only some half-dozen survivors of the Fellows elected during the previous eight years of its existence. Among those who have held office on its Council, Sir Rawson's seniority was undisputed, as he had been first elected on that body in 1841, and from first to last served as Councillor no less than nineteen years, his final resignation taking place less than two years ago. During this time his experience and business-like capacity were freely placed at the disposal of the Society, of which he became Vice-President in 1896.

Sir Rawson Rawson entered public life in 1841 as private secretary to Mr. Gladstone on the appointment of the latter as Vice-President of the Board of Trade. During the greater part of his public career, however, he was connected in one way or another with colonial administration, being appointed Chief Secretary for Canada in 1842, and shortly afterwards Treasurer of Mauritius, which office he held for a considerable period. In 1854 he became Colonial Secretary at the Cape, and ten years later was promoted to be Governor of the Bahamas, whence he was transferred to the same post in the Windward islands in 1869. In 1875 he retired, being created K.C.M.G. in acknowledgment of his services. During the remainder of his life, Sir Rawson was well known as a zealous statistician, paying special attention to the trade of the British Empire, of which, among other writings, he published a useful synopsis in 1888. While governor of the Windward islands he had dealt, in a report published in 1874, with the rainfall of Barbadoes and its influence upon the sugar crops. After his return to this country, when the "scramble for Africa" began to attract general attention, he contributed to our *Proceedings* for 1884 a valuable summary of the claims of the several European nations on the coasts of that continent, supplementing the paper the following year with a more detailed discussion of European territorial claims on the Red sea coasts.

CORRESPONDENCE.

Longitude of Nkata Bay, Lake Nyasa.

December 17, 1899.

I THINK that the difficulty mentioned in this month's *Journal* (p. 667) as to the longitude of Nkata bay on Lake Nyasa can be explained. After we had determined the longitude, I sent our value to H.M. acting Consul-General at Zomba for his information. In the next copy of the *B.C.A. Gazette* he printed it, with the remark that the previously accepted longitude was 6 miles in error. I believe that Dr. Gill's statement is quite correct, and based on this. No doubt the best map available was used for the comparison. This was *before* the value of Lieuts. Rhoades and Phillips was published (or rather had reached Central Africa). Lieut. Rhoades's value does not depend on Blantyre, but, as I understand, is an independent chronometer value brought up from the coast. Such an accordance with the telegraphic value as actually occurred, is remarkable.

As regards the error in the longitude of Blantyre, that still remains unknown. We were unexpectedly prevented from determining this telegraphically. My own view is that, as the value of Blantyre is the mean of eighty-one absolute determinations, it should not be more than half a mile in error.

Perhaps the B.C.A. Survey Department might be moved to settle this in conjunction with Dr. Gill, H.M. astronomer at the Cape, when the war is over.

C. F. CLOSE,
Capt. R.E.

The Mansarowar and Rakastal Lakes.*

1st Batt. 3rd Gurkhas, Almora, N.W.P., October 12, 1899.

Mr. Walter Savage Landor, whose introductory letter I enclose, was very anxious that I should write to you to state that in August, 1895, when up

* This letter is addressed to the President.

travelling in Tibet with my father, General Channer, I practically crossed the ridge dividing the Mansarowar and Rakastal lakes. I was on the look-out for burrel at the time, so kept along the crest as much as possible. I saw no "ditch" connecting the two sheets of water. The connection I believe to be a tunnel. The pundits with whom I have talked over the matter deny any cutting between the lakes. Moorcroft, in 1842, I believe, crossed the ridge and saw no ditch. I hope this information may be of some use to help this disputed point.

G. KENDALL-CHANNER.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1899–1900.

Second Ordinary Meeting, November 27, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Henryk Arctowski, Meteorologist to the Belgian Antarctic Expedition; Antonio Joaquim Basto, Jun.; Charles Clive Bigham; William Bleloch; Ernest Horsford Bingley; Alexander Claude Forster Boulton; W. A. Frank Balfour Broune; William T. H. Bradley; Lieut. Norman Edwin Oswell Philip Canning, R.N.R.; Thomas B. Clarke-Thornhill; Francis J. Collinson; Adolphus Coustol; Vice-Consul William Edward B. Copland Crawford; Pierre Bons D'Anty; Rev. Curtis Hoyt Dickins; R. Jeffrey Donohue; Major Edward Dorset Farmer-Bringhurst, F.R.C.S.; Captain John David Ferguson, D.S.O.; Randall John Fox; Major Charles James Fox; Captain H. C. Fraser* (*1st Life Guards*); *Charles Alfred Gibbes; William Goodacre; Harold W. Gough, M.A., F.C.S.; Major Walter Wingate Gray* (*Berwick and Lothian Yeomanry*); *Thomas Jones Gibb Duncanson, M.A., F.Z.S.; Shipton Green; Charles Kennerley Hall; Sholto Henry Hare; William Roland Hart; Richard Kilvington Hattersley; Arthur Frederick Herbert; Arthur Herbert Jocelyn Hill; J. Bernard Stoughton Holborn; George Jamieson, C.M.G.; Captain Gilbert Ward Johnson* (*3rd Punjab Cavalry*); *Albert Kendall; Arthur Landsberg; George Ruthven Le Hunte, C.M.G.* (*Lieut.-Governor and Administrator of British New Guinea*); *Sigmund Lipmann; Leonard A. Lyall; Captain Mill Malcolm* (*Argyll and Sutherland Highlanders*); *Stewart Margetson; Frederick Thomas Middleton; Rev. Hugh Parry; C. V. A. Peel; Captain Francis Barrow Pearce* (*West Yorkshire Regt.*), *Deputy Commissioner, B.C.A. Protectorate; T. T. Phelps; Lieut. Francis William Pirrie* (*Indian Staff Corps*); *John St. Vincent Pletts; Percy Horace Gordon Powell-Cotton; Archdeacon Francis D. Pritt; G. W. Prothero; Dr. G. R. Radmore; Colin Spittal Reddie; William Redman; Bertram Edward Sargeaunt; Hermann Schürhoff, Consul for Spain; Ernest Henry Shackleton* (*Officer, R.M.S. "Tantallon Castle"*); *A. Hastings Stewart; Lord Alexander Thynne; Charles Todd, M.D., M.R.C.S.; Philip David Warren* (*Assistant Surveyor-General of Ceylon*); *Lieut. William Alan Watts-Jones, R.E.; R. Valentine Webster; George Wilson; Captain A. W. S. Wingate* (*Indian Staff Corps*); *Captain J. E. S. Woodman* (*West India Regiment*).

The President read extracts from the letters of Major Gibbons and Mr. Percy Reid, who have been exploring, independently, in Barotseland; and of Mr. Arthur H. Sharp, who, with Mr. E. S. Grogam, has been travelling for about three years from Beira to Lake Tanganyika, Lake Kivu, Lake Albert Edward, and Uganda.

The Paper read was:—

"Desert Sand Dunes." By Vaughan Cornish.

Third Ordinary Meeting, December 11, 1899.—Colonel Sir T. H. Holdich, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

Elections.—*Edward Seymour Bell; Captain Ernest Leonard Cowie (West India Regiment); Rev. William Tudor Jones; Max Michaelson; Alfred Henry Spurrier, L.R.C.P.; Prof. Hans Steffen.*

Honorary Corresponding Members.

Captain Meliton Carbajal (President of the Peruvian Geographical Society); Prof. A. Bertrand (Professor of Topography and Engineering in the University of Santiago, Chile); Señor D. Samuel A. Quevedo (distinguished geographer and ethnologist of Buenos Aires.)

The Paper read was:—

"A Journey through Abyssinia to the Nile." By H. Weld Blundell.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciers. *Jahrb. Schweizer Alpenclub* **34** (1899): 275–297. **Forel, Lugeon, Muret.**
Les variations périodiques des glaciers des Alpes. Par Dr. F.-A. Forel, Dr. M. Lugeon, E. Muret. Dix-neuvième rapport. 1898. *With Illustration.*

Austria-Hungary. **Baedeker.**
Austria, including Hungary, Transylvania, Dalmatia, and Bosnia. Handbook for Travellers, by Karl Baedeker. With 30 Maps and 36 Plans. Ninth edition, revised and augmented. Leipsic: Karl Baedeker; London: Dulau & Co., 1900 [1899]. Size 6½ × 4½, pp. xvi. and 480. *Price 8s. Presented by Messrs. Dulau & Co.*

Austria-Hungary. *J. Manchester G.S.* **15** (1899): 11–23. **Latham.**
Visit to the Tatra. By J. B. Latham. *With Illustrations.*

Böhmerwald—Lakes. **Wagner.**

Die Seen des Böhmerwaldes. Eine geologisch-geographische Studie, zugleich ein Beitrag zur Lösung des Karproblems. Von Dr. Paul Wagner.—Wissenschaftliche Veröffentlichungen des Vereins für Erdkunde zu Leipzig. Vierter Band. Beiträge zur Geographie des mittleren Deutschland. Herausgegeben . . . Von Friedrich Ratzel. Leipzig: Duncker & Humblot, 1899. Pp. 1-90. *Maps and Illustrations.*

Particulars of the mountains, lakes, and tarns of the boundary district between Bavaria and Bohemia, which were sounded by the author, together with a discussion on the origin of corries.

Eastern Mediterranean. **Overbergh.**

Dans le Levant, en Grèce et en Turquie. Par Cyr. Van Overbergh. Bruxelles: O. Schepens et Cie, 1899. Size 7½ × 5, pp. xvi. and 422. *Illustrations. Presented by the Publishers.*

The journal of a pleasure trip on board one of the tourist yachts to the ports of Greece and those of European and Asiatic Turkey in the Ægean sea.

Europe. **Allen.**

The European Tour. A Handbook for Americans and Colonists. By Grant Allen. London: Grant Richards, 1899. Size 8 × 5⅛, pp. viii. and 294. *Price* 6*s. Presented by the Publisher.*

This book was written originally for Americans who wish to turn a single visit to Europe to the best account. It is now published in this country in the hope of being useful to colonial visitors as well. The sketch of the interesting tour through Europe is done in the late Mr. Allen's best style, and there is probably no one else who could give in so little space such a valuable indication of what is best worth seeing on the continent, always with the object of acquiring that education which travel alone can give.

United Kingdom—England. **Cuttriss.**

P. Yorkshire Geolog. and Polytechnic S. **13** (1899): 433–443.

Notes on the Caves of Yorkshire. Part ii. By S. W. Cuttriss. *With Plan and Plates. Also a separate copy presented by the Author.*

Describes the progress of speleological exploration in Yorkshire by the members of local scientific societies. The exploration of Gaping Ghyll and Rowten Pot is described in some detail.

United Kingdom—England. *Q.J. Geolog. S.* **55** (1899): 359–364. **Dakyns.**

The Limestone-knolls below Skipton and Grassington in Craven. By J. R. Dakyns.

United Kingdom—England. *Q.J. Geolog. S.* **55** (1899): 327–358. **Marr.**

On Limestone-knolls in the Craven District of Yorkshire and elsewhere. By J. E. Marr, F.R.S., etc. *With Illustrations.*

United Kingdom—Meteorology. **Brodie.**

Quarterly J. R. Meteorolog. S. **25** (1899): 181–202.

The Prolonged Deficiency of Rain in 1897 and 1898. By F. J. Brodie. *With Maps and Diagrams.*

United Kingdom—Scotland. **Penney.**

Handbook for Travellers in Scotland. Edited by Scott Moncrieff Penney, M.A. Seventh Edition. London: John Murray, 1898. Size 7 × 5, pp. xxxvi. and 480. *Maps and Plans. Price* 9*s. Presented by the Publisher.*

United Kingdom—Tide Tables. **Harris and Havergal.**

Tide Tables for the British and Irish Ports for the year 1900. Also the times and heights of high water at full and change for the principal places on the Globe. By Captain H. R. Harris and Commander A. Havergal. London: J. D. Potter. Size 10 × 6½, pp. xl. and 262. *Price* 2*s. Presented by the Hydrographer, Admiralty.*

United Kingdom—Wales. **Baddeley and Ward.**

Thorough Guide Series. North Wales (Part ii.), Llangollen, Bala, Dolgelley, Barmouth, Oswestry, Shrewsbury, Welshpool, Llanidloes, Machynlleth, and Aberystwith Sections. By M. J. B. Baddeley, B.A., and C. S. Ward, M.A. Fifth Edition. London: Dulau & Co., 1899. Size 6½ × 4½, pp. xvi. and 154. *Maps, Plans, and Panorama. Price* 2*s.* 6*d. Presented by the Publishers.*

United Kingdom—Wye Valley. **Buckman.**

The Valley of the Lower Wye. By S. S. Buckman, F.G.S. Reprinted from the *Proceedings of the Cotteswold Naturalists' Field Club*; vol. xiii. Part i., June, 1899. Size 10 × 6½, pp. 25–32. *Presented by the Author.*

Study of the evolution of a river-valley. The author points out that, on account of the more rapid erosion of the valley of the Usk and the proximity of the tributaries of that river to the Wye, the latter may possibly be ultimately diverted into the Usk.

ASIA.

Asia—Travels. *Nouv. Archives Miss. Sci.* **9** (1899): 55–101. **Chaffanjon.**

Rapport sur une mission scientifique dans l'Asie Centrale et la Sibérie. Par M. J. Chaffanjon. *With Map and Plan.*

Setting out in October, 1894, M. Chaffanjon visited Turkestan and Mongolia, proceeded to Vladivostok, and returned thence by sea. The work done comprised a route-survey from Tashkent to Urga *viâ* Kulja, and a new route in Eastern Mongolia from Urga to Blagoveschensk, as well as many astronomical determinations of positions. The archæological collections were extensive, including some from the ruins of Karakorum, and collections of zoological, botanical, and geological specimens were also made. The modes of life of the people were studied, and some folk-tales recorded.

British Asia. **Various Authors.**

India, Ceylon, Straits Settlements, British North Borneo, Hong-Kong. (The British Empire Series, vol. i.) With Two Maps. London: Paul & Co, 1899. Size 8½ × 6, pp. xxviii. and 536. *Price* 6*s.* *Presented by the Publishers.*

This volume is made up of lectures delivered at the South Place Institute, Finsbury, between 1895 and 1898. After an introduction by Sir Raymond West, there are twenty-three chapters by capable authorities. Mr. J. A. Baines gives "A general view of India and its people" and "Famines in India;" Bombay is treated by Lord Harris, Madras by Lord Wenlock, Sind by A. F. Baillie, Bengal by Romesh Dutt, the Punjab by Sir J. B. Lyall, the Central Provinces by Sir Charles Grant, Industries in India by Sir M. M. Bbownaggree. The lecture on Ceylon is by a former judge of the Ceylon Supreme Court, Mr. L. B. Clarence; that on Straits Settlements by a late Governor, Sir Andrew Clarke. The several chapters have been revised and brought to date by the authors, and statistical appendices and maps complete the volume.

Central Asia—Antiquities. **Hoernle.**

J. Asiatic S. Bengal **68** (Pt. i., extra No. 1, 1899): xxxii., 1–110.

A Collection of Antiquities from Central Asia. Part i. By A. R. Rudolf Hoernle. *With Map.*

China. *Export* **21** (1899): 425–427, 441–442, 458–459. ———

Die Franzosen und Engländer in Südchina.

China. **Colquhoun.**

China in Transformation By Archibald R. Colquhoun. With Frontispiece, Maps, and Diagrams. London and New York: Harper & Bros., 1898. Size 9 × 6, pp. viii. and 398.

China—Shantung. *Ann. Hydrographie* **27** (1899): 481–483. ———

Aus den Reiseberichten Seiner Majestät Schiffe. *With Map and Illustrations.*

On the south-eastern promontory of Shantung, with chart and views.

India. *J. East India Assoc.* **30** (1899): 31–71. **Elliott.**

The recent Famine in India and the Reports of the Second Famine Commission. By Sir Charles Elliott, K.C.S.I., etc. *With Map.*

India. **Steevens.**

In India. By G. W. Steevens. London: W. Blackwood & Sons, 1899. Size 8 × 5½, pp. viii. and 366. *Map. Price* 6*s.* *Presented by the Publishers.*

Impressions of India, written with a vivid force which makes a series of remarkable word-pictures.

India and China—Railway. *Fortnightly Rev.* **66** (1899): 759–768. **Stuart.**

Direct Railway Communication between India and China. By James Stuart. *With Map.*

Mr. Stuart urges the importance of the railway route from Assam to the Yangtse proposed by Captain Blakiston in 1862, through a belt of territory in 27° N. which has not yet been explored by any white man.

India—Assam. ——

Report on the Administration of the Province of Assam for the year 1897-98. Shillong, 1899. Size 13½ × 8½, pp. xiv., 214, and ccxliv. *Map.*

India—Bombay, etc. *J.S. Arts.* **47** (1899): 731-739. **Birdwood.**

The Hill Forests of Western India.

India—Bombay Observations. ——

Magnetical and Meteorological Observations made at the Government Observatory, Bombay, 1897, under the direction of N. A. F. Moos. With an Appendix. Bombay, 1898. Size 14 × 10, pp. xviii., 18, 12, and 6.

India—Botanical Survey. ——

Report of the Director of the Botanical Survey of India for the year 1898-99. Size 13 × 8½, pp. 38.

Indo-China. **Pavie.**

Mission Pavie Indo-Chine, 1879-1895. Études Diverses. I. Recherches sur la Littérature du Cambodge, du Laos et du Siam. Par Auguste Pavie. Paris: E. Leroux, 1898. Size 11 × 9, pp. xlvi. and 370. *Map and Illustrations.*

A number of Indo-Chinese folk-tales with quaint native illustrations, many of them reproduced in colours.

Japan. **Chamberlain and Mason.**

A Handbook for Travellers in Japan, including the whole empire from Yezo to Formosa. By Basil Hall Chamberlain and W. B. Mason. Fifth Edition. London: John Murray, 1899. Size 7½ × 5, pp. x. and 578. *Maps and Plans. Price* 20*s. Presented by the Publisher.*

Japan. *J. College Sci. Imp. University Tōkyō* **11** (1899): 161-195. **Omori and Hirata.**

Earthquake Measurement at Miyako. By F. Omori, D.Sc., and K. Hirata. *With Maps and Diagrams.*

Japan—Formosa. *Globus* **76** (1899): 217-222. **Schumacher.**

Eine Reise zu den Tschin-huan in Formosa. Von Rob. Schumacher. *With Illustrations.*

Korea. **Bret.**

Miss. Catholiques **31** (1899): 174, 189, 198, 213, 222, 236, 248, 260, 288, 286, 297, 309, 321, 333, 344, 354, 366, 382, 394, 402, 413, 425, 437, 451.

Dans la Corée Septentrionale. Par M. Bret. *With Maps and Illustrations.*

Malay Archipelago—Borneo. **Furness.**

Folk-Lore in Borneo: a Sketch. By William Henry Furness, 3d, M.D. Wallingford, Penn., 1899. Size 8½ × 6, pp. 30. *Illustrations. Presented by the Author.*

An interesting set of folk-tales and descriptions of customs collected by the author during a recent sojourn in Borneo. There are also some remarkably fine photographs of native Borneans.

Malay Archipelago—Borneo. **Keyser.**

Trade of Borneo and Sarawak for the year 1898. Foreign Office, Annual No. 2322, 1899. Size 10 × 6½, pp. 10. *Price* 1*d.*

Malay Archipelago—Java. **Schlegel.**

Geographical Notes. XII. Shay-Po, Djarâ. By G. Schlegel. Reprinted from the *T'oung-Pao*, vol. x. No. 3. Leyden: E. J. Brill, 1899. Size 10 × 6½, pp. 62. *Plate. Presented by the Author.*

Malay Archipelago—Sumatra. **Volz.**

Tijds. K Ned. Aard. Genoots. Amsterdam **16** (1899): 415-485.

Zum Toba-See in Central-Sumatra. Von Dr. Wilhelm Volz. *With Map.*

A sketch of the history of exploration round the Toba lake in Sumatra, followed by a report of the author's journey in that region in 1898. He inquired specially into the existence and limitations of anthropophagy amongst the Battaks, and has much to say on the subject.

Malay States. **Swettenham.**

Report by the Resident-General of the Federated Malay States to His Excellency the High Commissioner (Sir Charles Bullen H. Mitchell, G.C.M.G.). Kuala Lumpur, 1899. Size 13½ × 8½, pp. 10.

Malay States—Negri Sembilan. **Birch.**

Negri Sembilan Administration Report, 1898. Seremban, 1899. Size 13½ × 8½, pp. 16 and xx.

Malay States—Pahang. **Clifford.**

Annual Report of the State of Pahang for the year 1898. By Hugh Clifford. Kuala Lumpur, 1899. Size 13½ × 8½, pp. 24.

Malay States—Perak. **Treacher.**

Perak Administration Report for the year 1898. By W. H. Treacher, C.M.G. Taiping. Size 13½ × 8½, pp. 64. *Illustration.*

Philippine Islands. **Algué.**

Observatorio de Manila. Las Nubes en el Archipiélago Filipino. Colaboración al Trabajo Internacional de Medición de Nubes [1° Junio 1896–31 de Julio 1897]. Por el P. José Algué, S.J. Manila, 1899. Size 12½ × 9, pp. xvi., 86, and 43.

On the clouds in the Philippine islands.

Philippine Islands. **Harford.**

Trade of the Philippine Islands for the year 1898. Foreign Office, Annual No. 2319, 1899. Size 10 × 6½, pp. 18. *Price* 1½*d.*

Persia. *Petermanns M.* **45** (1899): 215–217. **Sarre.**

Reise von Ardebil nach Zendschan im nordwestlichen Persien. Von Dr. Fr. Sarre. *With Map.*

Russia—Caucasus. **Lojka and Déchy.**

Lichenes in Caucaso et in peninsula Taurica ab. H. Lojka et M. a Déchy Collecti. Enumeravit E. A. Wainio præfationemque scripsit M. a Déchy. (Ex. *Természetrajzi Füzetek*, xxii., 1899.) Size 10½ × 7, pp. 269–343. *Presented by M. de Déchy.*

Russia—Siberia. *Globus* **76** (1899): 166–172. **Stenin.**

Jochelsons Forschungen unter den Jukagiren am Jassatschnaja und Korkodon. Von P. v. Stenin. *With Illustrations.*

Siam. *J. East India Assoc.* **30** (1899): 7–22. **Barrett.**

Siam and its Neighbours. By the Hon. John Barrett.

Turkey—Asia Minor. *Deutsche Rundschau G.* **21** (1899): 354–361. **Friedrich.**

Geographisch-Statistisches vom Wilajet Smyrna. Von Dr. Ernst Friedrich. *With Map, Plan, and Illustrations.*

Turkey—Babylonia. **Hilprecht.**

B. Free Museum Sci. and Art University of Pennsylvania **2** (1899): 87-91.

The Recent Excavations of the University at Nippur. By Prof. H. V. Hilprecht. *With Plates.*

Turkey—Baghdad and Bussorah. **Loch and Wratislaw.**

Trade of Baghdad and Bussorah for the year 1898. Foreign Office, Annual No. 2316, 1899. Size 10 × 6½, pp. 10. *Price* 1*d.*

AFRICA.

Africa—Partition. *Wesleyan Miss. Notices* (1899): 145–147. **Halligey.**

The Transformation of Africa. By Rev. J. T. F. Halligey. *With Map.*

British Africa. **Various Authors.**

British Africa. (The British Empire Series, vol. ii.) With Four Maps. London: Paul & Co., 1899. Size 8½ × 6, pp. xiv. and 414. *Price* 6*s. Presented by the Publishers.*

A collection of lectures delivered at the South Place Institute, Finsbury, supplemented by other writings by various authors, with an introduction by Dr. J. Scott Keltie. The parts of Africa dealt with are the Cape of Good Hope, Rhodesia, Bechuanaland, the Transvaal, Natal, British Central Africa, Zanzibar, British East Africa, including Uganda, Egypt, and the West African Colonies. There is also a chapter on Mauritius.

Cape Colony.

Statistical Register of the Colony of the Cape of Good Hope for the Year 1898, with Supplement for March Quarter, 1899. Cape Town, 1899. Size 13 × 8½, pp. xvi. and 361. *Diagram.*

Central Africa. *Mouvement G.* **16** (1899): 553–555. ——

Le plateau du Tanganika et le "Graben" du lac Rikwa.

Comoro Islands—Mayotte. *M.G. Ges. Wien* **42** (1899): 263–285. **Couarde.**

Eine Skizze über Mayotte. Von G. Couarde, K. u. K. Fregatten-Capitän.

Notes based on a visit by an Austro-Hungarian training ship in 1899.

Egypt. **Penfield.**

Present-day Egypt. By Frederic Courtland Penfield. London: Macmillan & Co., 1899. Size 8½ × 6, pp. xiv. and 372. *Map and Illustrations. Price* 10*s*. *Presented by the Publishers.*

Mr. Penfield was United States Diplomatic Agent and Consul-General to Egypt in 1893–97; his book, intended for the reader who wishes a general account of Egypt at the present day, is consequently one of some authority. It contains a description of Cairo, and Alexandria, a brief history of the Suez Canal, chapters on the various public works, on several important matters of administration, on the position of Great Britain in Egypt, and on wintering in Egypt for health's sake. The illustrations are partly from drawings by Paul Philippoteaux and R. Talbot Kelly, and partly from photographs.

Egyptian Sudan. *P.R.S.* **65** (1899): 333–349. **Budge.**

On the Orientation of the Pyramids and Temples in the Sûdân. By E. A. Wallis Budge, M.A.

French Sahara. *B.S.G. Com. Bordeaux* **22** (1899): 403–413. **Bénard.**

Le chemin de fer transsaharien au Congrès de géographie d'Alger. Par M. Charles Bénard. *With Map.*

French Sahara. *Nouv. Archives Miss. Sci.* **9** (1899): 513–519. **Périn.**

Rapport sur la mission Foureau-Lamy. Par M. G. Périn.

Preliminary plan of the expedition from Algeria to Lake Chad through the Tuareg country.

German East Africa. *Petermanns M.* **45** (1899): 166–167. **Meyer.**

Aus Th. Meyers Bericht über seine Reise zur Anlage neuer Stationen im Njika und Bundali-Land im November 1898. *With Map.*

German East Africa. **Widenmann.**

Die Kilimandscharo-Bevölkerung. Anthropologisches und Ethnographisches, aus dem Dschaggalande. Von Dr. A. Widenmann.—Dr. A. Petermanns Mitteilungen. Ergänzungsheft Nr. 129. Gotha: Justus Perthes, 1899. Size 11 × 7½, pp. x. and 104. *Illustrations.*

A careful and fully illustrated anthropological description of the Jaggas.

Morocco. **Doutté.**

Les Djebala du Maroc d'après les travaux de M. Auguste Mouliéras. Par Edmond Doutté. Oran: L. Fongue, 1899. Size 10 × 6½, pp. 42. *Presented by the Author.*

Morocco. **Maclean.**

Trade of Dar-al-Baida and District for the years 1897 and 1898. Foreign Office, Annual No. 2323, 1899. Size 10 × 6½, pp. 40. *Price* 2½*d*.

Mauritius. *Tour du Monde* **5** (1899): 445–456. **Verschuur.**

L'Ile Maurice. Par M. G. Verschuur. *With Illustrations.*

Niger Basin. *Mouvement G.* **16** (1899): 163–165, 169–171. ——

Le bassin du Niger.

Niger. **Guy.**

Renseignements Colon., Comité l'Afrique Française (1899): 1–13, 17–30, 33–48.

Les résultats géographiques et économiques des explorations du Niger. Par M. Camille Guy. *With Maps.*

Northern Africa. **Bernard.**

Revue Bibliographique des Travaux sur la Géographie de l'Afrique Septentrionale. Par Augustin Bernard. Extrait du 'Bulletin de la Société de Géographie d'Alger.' Alger, 1899. Size 9½ × 6½, pp. 28. *Presented by the Author.*

Notes on the bibliography of Northern Africa.

Portuguese East Africa—Chinde. **Hillier.**

Trade of Chinde for the year 1898. Foreign Office, Annual No. 2328, 1899. Size 10 × 6½, pp. 10. *Price* 1*d*.

Réunion. *Tour du Monde* **5** (1899): 457–468. **Verschuur.**
L'Ile de la Réunion. Par M. G. Verschuur. *With Illustrations.*

Sahara. *Rev. Scientifique* **12** (1899): 161–172. **Duponchel.**
La colonisation africaine et les chemins de fer transsahariens. Par M. A. Duponchel.

Sahara. *B. Comité l'Afrique Française* **9** (1899): 113–115. **Leroy-Beaulieu.**
Le tracé du Transsaharien. Par M. Paul Leroy-Beaulieu.

Sahara. *Petermanns M.* **45** (1899): 174–175. **Supan.**
Ueberschwemmung in der Sahara. Von Prof. Dr. A. Supan.

Sierra Leone. ———
Report by Her Majesty's Commissioner and Correspondence on the Subject of the Insurrection in the Sierra Leone Protectorate, 1898. Part i.—Report and Correspondence. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 176. *Price* 1*s.* 5½*d.*

Sierra Leone. ———
Sierra Leone. Report by Her Majesty's Commissioner and Correspondence on the Subject of the Insurrection in the Sierra Leone Protectorate, 1898. Part ii.—Evidence and Documents. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. x. and 682. *Price* 5*s.* 6*d.*

Somaliland. **Vannutelli and Citerni.**
Seconda Spedizione Bòttego. L'Omo. Viaggio d'esplorazione nell' Africa Orientale narrato da L. Vannutelli e C. Citerni. Sotto gli auspici della Società Geografica Italiana. Milano: U. Hoepli, 1899. Size 10½ × 7, pp. xvi. and 650. *Portrait, Maps, and Illustrations. Presented by the Publisher.*

Sudan Boundaries. *Questions Dipl. et Colon.* **6** (1899): 385–392. **Lanessan.**
La Convention Franco-Anglaise du 21 Mars 1899. Par J. L. de Lanessan. *With Map.*

Transvaal. ———
South African Republic. Correspondence relating to the Status of the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 34. *Price* 3½*d.*

Transvaal. ———
South African Republic. Further Correspondence relating to Proposed Political Reforms in the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. x. and 74. *Price* 8½*d.*

Transvaal. ———
South African Republic. Further Correspondence relating to Proposed Political Reforms in the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. vi. and 76. *Price* 8*d.*

Transvaal. ———
Further Correspondence relating to Political Affairs in the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. viii. and 66. *Price* 7½*d.*

Welwitsch's African Plants. **Hiern and Rendle.**
Catalogue of the African Plants collected by Dr. Friedrich Welwitsch in 1853–61. Dicotyledons. Part iii.—*Dipsaceæ* to *Scrophulariaceæ*. By William Philip Hiern, M.A., F.L.S. Vol. ii., Part i. Monocotyledons and Gymnosperms. By Alfred Barton Rendle, M.A., etc. London: Longmans & Co., 1898–99. Size 9 × 5½, pp. (part iii.) 511–784, (vol. ii. part i.) 260. *Presented by the British Museum.*

West Africa. **Darwin.**
British Expansion in West Africa. By Major L. Darwin. From the *National Review*, August, 1899, pp. 968–979. Size 10 × 6½.

West African Boundaries. ———
Treaty Series, No. 15, 1899. Convention between the United Kingdom and France for the Delimitation of their respective Possessions to the West of the Niger, and of their respective Possessions and Spheres of Influence to the East of that river. Signed at Paris, June 14, 1898. Together with a Declaration completing the same. Signed at London, March 21, 1899. London: Eyre & Spottiswoode, 1899. Size 9½ × 6½, pp. 20. *Maps. Price* 10½*d.*

NORTH AMERICA.

Alaska. **Hitchcock.**

Two Women in the Klondike. The Story of a Journey to the Gold-Fields of Alaska. By Mary E. Hitchcock. New York and London: G. P. Putnam's Sons, 1899. Size 9 × 6, pp. xiv. and 486. *Map and Illustrations. Price* 12*s.* 6*d. Presented by the Publishers.*

This is a detailed record of the incidents of a voyage up the Yukon, undertaken in 1898 by two wealthy American ladies, with graphic notes of their picknicking at Dawson for the short autumn, and their return journey just at the onset of winter up the Yukon and the lakes to the White pass and home by Skagway. There are some excellent photographs and a good map.

Canada. *P. Canadian I.* **2** (1899): 61–73. **Penck.**

Observations made on a Tour in Canada. By Albert Penck.

On the trip across Canada, made on the occasion of the British Association Meeting in 1897.

Canada—British Columbia. *P. Canadian I.* **2** (1899): 57–60. **Penck.**

The Illecillewaet Glacier in the Selkirks. By Albert Penck.

Canada—Historical. *Deutsche G. Blätter* **22** (1899): 170–201. **Nederkorn.**

Die Entdeckungs-, Besiedlungs- und Entwicklungsgeschichte Canadas und seiner Grenzgebiete. Von Dr. W. Nederkorn.

Mexico. *Nouv. Archives Miss. Sci.* **9** (1899): 571–630. **Diguet.**

Rapport de Mission. Par M. Léon Diguet. (La Sierra du Nayarit et ses indigènes.) *With Maps and Plates.*

Mexico—Lower California. *Nouv. Archives Miss. Sci.* **9** (1899): 1–53. **Diguet.**

Rapport sur une mission Scientifique dans la Basse Californie. Par M. Léon Diguet. *With Plates.*

A full geographical and ethnographical description of Lower California.

North America. **Newberry.**

Monographs of the United States Geological Survey. Vol. xxxv. The Later Extinct Floras of North America. By John Strong Newberry. A posthumous work, edited by Arthur Hollick. Washington, 1898. Size 12 × 9½, pp. xviii. and 152. *Plates. Presented by the U.S. Geological Survey.*

United States—Coast and Geodetic Survey. ———

Report of the Superintendent of the U.S. Coast and Geodetic Survey, showing the progress of the work during the fiscal year ending with June, 1897. Washington, 1898. Size 12 × 9½, pp. xxii. and 774. *Maps and Illustrations. Presented by the Survey.*

CENTRAL AND SOUTH AMERICA.

Argentine—Aconcagua. **Fitz Gerald.**

The Highest Andes: a Record of the First Ascent of Aconcagua and Tupungato in Argentina, and the Exploration of the Surrounding Valleys. By E. A. Fitz Gerald. With Chapters by Stuart Vines, M.A., and Contributions by Prof. Bonney, D.SC., G. C. Crick, R. J. Pocock, G. A. Boulanger, F.R.S., J. H. Burkill, Philip Gosse. London: Methuen & Co., 1899. Size 10 × 6½, pp. xvi. and 390. *Maps and Illustrations. Price* 30*s. Two copies, one presented by the Author, the other by the Publishers.*

This volume gives a finely illustrated description of Mr. Fitzgerald's important expedition to Aconcagua, the geographical details of which were published in the *Journal* for November, 1898. The illustrations include panoramas from great elevations. Appendices deal at considerable length with the scientific collections and observations made by different members of the expeditions, and there is an index to the whole work.

Argentine—Buenos Aires. *P.I. Civil Engineers* **138** (1899): 170–243. **Dobson.**

Buenos Ayres Harbour Works. By J. M. Dobson. *With Plans.*

Brazil. **Coudreau.**

Henri Coudreau. Voyage au Yamunda, 21 Janvier 1899—27 Juin 1899. Paris: A. Lahure, 1899. Size 11½ × 9, pp. 164. *Maps and Illustrations.*

In this journey M. Coudreau ascended the Yamunda tributary, on the left bank of the Amazon, to 0° 33′ S. in lat. 59° 24′ W. of Greenwich, thus entering an entirely

unexplored region. The description is illustrated by photographs, and accompanied by a map on the scale of 1 : 100,000; but not provided with a scale of lengths, latitudes, longitudes, statement as to projection, nor any means of showing how the six sheets of which it is composed fit together.

Haiti. *Petermanns M.* **45** (1899): 153–155; 201–204. **Tippenhauer.**

Beiträge zur Geologie Haïtis. Von L. Gentil Tippenhauer. *With Map.*

Jamaica. **Hemming.**

Jamaica. Annual Report for 1897–8. Colonial Reports, Annual No. 261, 1899. Size 10 × 6¼, pp. 56. *Price* 3*d.*

Jamaica. *J.I. Jamaica* **2** (1899): 502–509. **Nicholas.**

The Economic Geology of Jamaica. By F. C. Nicholas.

Peru. *B.S.G. Lima* **8** (1898): 193–237. ——

Informe que la Sociedad Geográfica de Lima presenta al Supremo Gobierno, sobre demarcación. Por departamentos, del territorio de la República.

Peru. *B.S.G. Lima* **8** (1898): 171–179. **Hilfiker.**

Informe sobre la zona mineral de Ananea-Poto. Por el ingeniero Adolfo Hilfiker. *With Map.*

Peru. *B.S.G. Lima* **8** (1898): 278–320. **Ráez.**

Tayacaja; Monografía de esta provincia del departamento de Huancavelica. Por Nemesio A. Ráez.

Peru. *B.S.G. Lima* **8** (1899): 241–277. **Raimondi.**

Itinerario de los viajes de Raimondi en el Perú; Cuzco, Quispicanchi, Lucré, Pisac, etc., hasta Marcapata (1865).

Peru. **Tizón y Bueno.**

Breve estudio geografico-estadistico del Departamento de La Libertad. Por Ricardo Tizón y Bueno. Lima, 1899. Size 7½ × 5½, pp. 54.

Peru—Callao. *B.S.G. Lima* **8** (1898): 350–355. **Remy.**

Climatología del puerto del Callao en 1898. Por Federico Remy.

Rio de la Plata. **Martinez.**

Etnografía del rio de la Plata. Discurso pronunciado . . . por Benigno T. Martinez. 1899. Size 7½ × 5½, pp. 26. *Presented by the Author.*

Venezuela. **Haggard.**

Trade of Venezuela for the year 1898. Foreign Office, Annual No. 2315, 1899. Size 10 × 6¼, pp. 34. *Price* 2½*d.*

Venezuela Boundary. ——

Venezuela. Nos. 1, 2, and 3 (1899). Boundary between British Guiana and Venezuela. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. (No. 1) 164; (No. 2) 142; (No. 3) 56. *Price* (No. 1) 1*s.* 4*d.*; (No. 2) 1*s.* 2*d.*; (No. 3) 6*d.*

The text of the British case as presented to the Court of Arbitration in Paris.

West Indies. ——

West Indian Bulletin. The Journal of the Imperial Agricultural Department for the West Indies, vol. i. No. 1. London: Dulau & Co. [1899]. Size 10 × 6¼, pp. 142. *Presented by the Commissioner of the Imperial Department of Agriculture for the West Indies.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Flora. *Natural Sci.* **15** (1899): 198–212, 274–286. **Moore.**

Suggestions upon the Origin of the Australian Flora. By Spencer Moore, B.SC.

Caroline Islands. **Christian.**

The Caroline Islands. Travel in the Sea of the Little Lands. By F. W. Christian. London: Methuen & Co., 1899. Size 9 × 6, pp. xiv. and 412. *Map, Plans, and Illustrations. Price* 12*s.* 6*d. Presented by the Publishers.*

This records a long residence in the Caroline islands, including travels through the group, and dwells especially on the island of Ponapé, though the author has much to say also about Yap, and about many of the smaller islands which lie between. The appendices contain much precise information of an original kind on the anthropology and archæology of the group, so that when the new owners of the islands undertake

the minute surveys and investigations they are sure to institute, they will find a great deal of the work done for them by Mr. Christian. A general summary of the results of these studies will be found in the *Journal* for February, 1899, vol. xiii. p. 105.

Hawaii. **Brigham.**

Hawaiian Feather Work. By William T. Brigham.—Memoirs of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History (vol. i. No. 1). Honolulu, 1899. Size 12½ × 10, pp. 82. *Illustrations. Presented by the Bernice Pauahi Bishop Museum, Honolulu.*

New Guinea. **Krieger.**

New Guinea, von Dr. Maximilian Krieger, mit Beiträgen von Professor Dr. A. Freiherrn von Danckelman, Professor Dr. F. von Luschan, Kustos Paul Matschie und Professor Dr. Otto Warburg mit Unterstützung der Kolonial-Abteilung des Auswärtigen Amtes, der Neu-Guinea-Kompagnie und der Deutschen Kolonial-Gesellschaft.—Bibliothek der Länderkunde, herausgegeben von Prof. Dr. Alfred Kirchhoff und Dr. Rudolf Fitzner. Fünfter und sechster Band. Berlin: A. Schall, 1899. Size 10½ × 7, pp. xii. and 536. *Maps and Illustrations. Presented by the Publisher.*

An important work dealing with all parts of the great island of New Guinea, first in its general aspects, and then with particular regard to each of the three possessions, which are treated in considerable detail.

New Zealand. **Smith.**

Report of the Department of Lands and Survey, New Zealand, for the year 1898–99. By S. P. Smith, Surveyor-General. Wellington, 1899. Size 13½ × 8½, pp. iv., xxiv., and 276. *Maps and Illustrations. Presented by the Department of Lands and Survey, New Zealand.*

New Zealand—Flora. **Kirk.**

The Students' Flora of New Zealand and the Outlying Islands. By Thomas Kirk. Wellington, [1899]. Size 10 × 7½, pp. vi. and 408. *Presented by the New Zealand Government.*

The death of the compiler of this list of New Zealand plants deprives the work of a chapter on the geographical distribution of plants in New Zealand, which he had planned as an introduction.

Queensland. *P.I. Civil Engineers* **136** (1899): 268–281. **Williams.**

Floods in the Brisbane River; and a System of Predicting their Heights and Times. By C. J. R. Williams. *With Map and Diagrams.*

South Australia—Meteorology. **Todd.**

Meteorological Observations made at the Adelaide Observatory and other places in South Australia and the Northern Territory during the Year 1896, under the direction of Charles Todd, K.C.M.G. Adelaide, 1899. Size 13½ × 8½, pp. xiv., 96, and 82. *Maps. Presented by the Adelaide Observatory.*

Victoria. **Bride.**

Public Library, Museums, and National Gallery of Victoria. Letters from Victorian Pioneers: being a series of papers on the Early Occupation of the Colony, the Aborigines, etc. Edited . . . by Thomas Francis Bride, LL.D. Melbourne: R. S. Brain, 1899. Size 9 × 6, pp. xiv. and 326. *Map. Presented by the Public Library of Victoria.*

The fifty-eight letters now published for the first time were collected from early settlers by Governor La Trobe in 1853, when he had the intention of writing a history of Victoria. Each letter gives the recollections of one of the pioneer settlers concerning events in which he had taken part not more than seventeen years in any case before the time at which he wrote. The letters are full of information as to the aborigines.

AUSTRALASIA AND OCEANIC ISLANDS.

Solomon Islands. *Ann. Hydrographie* **27** (1899): 529–535. ———

Aus den Reiseberichten Seiner Majestät Schiffe. *With Maps and Illustration.*

A cruise round Bougainville island.

Western Australia. *Mission Field* **44** (1899): 403–408. **Burton.**

On a Bicycle in Australian Wilds. By the Rev. Alfred. *With Illustrations.*

A bicycle ride from Norseman to Eucla in Western Australia. It is mentioned incidentally that the ordinary means of communication with Eucla is by a steamer, which calls there once in three months.

Western Australia. *Ann. Hydrographie* **27** (1899): 540–542. **Tiedemann.**

Der Hafen von Bunbury. Nach Bericht von Kapt. H. Tiedemann. *With Map.*

On Bunbury harbour.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Date-line. **Smith.**

Where a day is lost or gained. By Benjamin E. Smith. From the *Century Magazine*, September, 1899, pp. 742–745. *Map.*

On the line of change of date in the Pacific ocean.

Latitude Changes. **Sande Bakhuysen.**

P. Section Sci., K.A. Wetens. Amsterdam **1** (1899): 42–55.

On the Motion of the Pole of the Earth according to the observations of the years 1890–1896. By Dr. E. F. van de Sande Bakhuyzen.

The publication of an English edition of the Proceedings of the Scientific Section of the Royal Academy of Amsterdam will be welcomed by all men of science who are ignorant of the Dutch language. This memoir summarizes the recent observations on the shifting of the pole.

Latitude Changes. **Sande Bakhuysen.**

P. Section Sci., K.A. Wetens. Amsterdam **1** (1899): 201–213.

Some remarks upon the 14-monthly motion of the Pole of the Earth and upon the length of its period. By Dr. E. F. van de Sande Bakhuyzen.

Latitude Determination. *C.Rd.* **129** (1899): 270–272. **Ebert and Perchot.**

Sur les méthodes de M. Lœwy pour la détermination des latitudes. Note de MM. W. Ebert et J. Perchot.

Map-reading. *P.R. Artillery I.* **26** (1899): 339–340. **Prinsep.**

A Portable Map Reader for Field Service. By Major D. G. Prinsep.

Description of a ruler marked with scales for use in artillery work in the field.

Mean Density of Earth. **Rein.**

Bestimmung der mittleren Dichte der Erde. Von Prof. Rein. (Separat-Abdruck aus den Sitzungsberichten der Niederrhein. Gesellschaft für Natur- u. Heilkunde Bonn, 1898.) Size 8½ × 5½, pp. 4. *Presented by the Author.*

The final corrected results of Richarz, Krigs, Menzel, and König gives 5·505 as the mean density of the Earth.

Nautical Almanac. ———

The American Ephemeris and Nautical Almanac for the year 1902. First Edition. Washington: Bureau of Equipment, 1899. Size 11 × 7½, pp. 588. *Diagram.*

Navigational Instruments. *Rev. Maritime* **142** (1899): 590–594. **Molfino.**

Navigation; les Nomogrammes du Professeur E. Molfino.

On a mechanical method of calculating latitudes.

Orometric Calculations. *Riv. G. Italiana* **6** (1899): 521–528. **Marinelli.**

Sopra un nuovo procedimento orometrico osservazioni di Olinto Marinelli.

Orrery. **Rosenbach.**

B. Free Museum Sc. and Art. Univ. of Pennsylvania **2** (1899): 73–86.

The Rittenhouse Orrery by Abraham S. Wolf Rosenbach. *Illustration.*

Notes regarding a remarkable planetarium in the Philadelphia museum constructed in 1771 by David Rittenhouse.

Position Determinations. *Ann. Hydrographie* **27** (1899): 505–512. **Fulst.**

Zur Berechnung des Schiffsortes aus zwei Gestirnshöhen nach der Höhenmethode. Von Dr. O. Fulst.

Prime Meridian. *A travers le Monde, Tour du Monde* **5** (1899): 285–286. **Combes.**

La Question du Méridien unique. Par M. Paul Combes. *With Map.*

Sunrise and Sunset. **Logan.**

No. III. U.S. Hydrographic Office. Sunrise and Sunset Tables showing the Local Mean Time of the Sun's visible rising and setting for each degree of latitude between 60° North and 60° South, and for each degree of the Sun's Declination. Washington, 1896. Size 11½ × 9½, pp. 24. *Presented by the U.S. Hydrographic Office.*

Time. *Riv. G. Italiana* **6** (1899): 529–541. **Rajna and Quarenghi.**
Una discussione sul' unificazione del calendario: il meridiano iniziale per le longitudini e l'ora universale. By Michele Rajna e Cesare Tondini de Quarenghi.

Time and Angles. *Rev. Scientifique* **12** (1899): 691–693. **Rey-Pailhade.**
Etat de la Question de la Décimalisation du Temps et de L'Angle. Par M. J. de Rey-Pailhade.

Time and Longitude. *Riv. G. Italiana* **6** (1899): 457–480. **Rajna.**
Una discussione su l'unificazione del calendario: il Meridiano Iniziale per le Longitudini e l'ora Universale. By Michele Rajna.

Time Standards. *Rev. Scientifique* **12** (1899): 526–530. **Quarenghi.**
Le méridien de l'heure universelle et la Russie. Par M. C. Tondini di Quarenghi.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Circulation. *Ann. Hydrographie* **27** (1899): 563–566. **Köppen.**
Ueber den Rücktransport der Luft nach niedrigen Breiten in den gemässigten Zonen. Von Prof. Dr. W. Köppen.
On the return currents of air towards low latitudes in the temperate zones.

Atmospheric Circulation. *Meteorolog. Z.* **16** (1899): 337–353, 397–411. **Polis.**
Die Strömungen der Luft in den barometrischen Minima und Maxima. Ein Beitrag zur Theorie der Cyklonen und Anticyklonen. Von Dr. P. Polis.
On the circulation of air in cyclones and anticyclones.

Geology. **Lapparent.**
Traité de Géologie. Par A. De Lapparent. Quatrième édition. Phénomènes Actuels. Page 1 à 592. Géologie proprement dite. Page 593 à 1240. [2 Parts.] Paris: Masson et C^ie^, 1900 [1899]. Size 10 × 6½. *Maps and Illustrations. Presented by the Author.*
A new and entirely recast edition of Prof. de Lapparent's well-known text-book of geology.

Geology. **Chamberlin.**
The Ulterior Basis of Time Divisions and the Classification of Geologic History. By T. C. Chamberlin. Reprinted from the *Journal of Geology*, vol. vi. No. 5, July–August, 1898. Chicago, 1898. Size 9½ × 7, pp. 449–526. *Presented by the Author.*

Geology. **Chamberlin.**
A Systematic Source of Evolution of Provincial Faunas and The Influence of Great Epochs of Limestone Formation upon the Constitution of the Atmosphere. Reprinted from *Journal of Geology*, vol. vi. No. 6, September–October, 1898. Chicago, 1898. Size 9½ × 7, pp. 597–621.

Geology—Age of Earth. *Scottish G. Mag.* **15** (1899): 561–578. **Geikie.**
Address to the Geological Section of the British Association, 1899. By Sir Archibald Geikie.
A discussion of the geological evidence bearing on the probable age of the stratified rocks formed since the first consolidation of the Earth's crust.

Geomorphology. **Benest.**
Submarine Gullies, River Outlets, and Fresh-Water Escapes beneath the Sea-Level. By Henry Benest. From the *Geographical Journal* for October, 1899. Size 10 × 6½, pp. 20. *Diagrams.*

Geomorphology. *J. of T. Victoria I. London* **31** (1899): 269–297. **Hull.**
On the Sub-Oceanic Terraces and River Valleys off the Coast of Western Europe. By Prof. Edward Hull. *With Maps and Sections.*

Geophysics. *Globus* **76** (1899): 174–176. ——
Die Ansichten über das Erdinnere. *With Illustration.*
A notice of Woldrich's study of the interior of the Earth published in the *Transactions* of the Prague Academy of Sciences, accompanied by a coloured diagram showing an ideal section of the Earth on the hypothesis that within the solid lithosphere lies a pyrosphere of intensely high temperature, and successively in a plastic, fluid, and finally at the centre gaseous state.

Glacial Period. *J. Geology* 7 (1899): 545–584. **Chamberlin.**

An Attempt to frame a Working Hypothesis of the Cause of Glacial Periods on an Atmospheric Basis. By T. C. Chamberlin.

Glacial Period. *J. of T. Victoria I. London* 31 (1899): 141–167. **Hull.**

Another Possible Cause of the Glacial Epoch. By Prof. E. Hull, LL.D., F.R.S., etc. *With Map.*

Prof. Hull brings forward evidence which inclines him to believe that the Glacial period was brought about by changes in the Earth's crust sufficient to deflect the warm currents from the northern seas.

Land Forms. *Ann. G.* 8 (1899): 289–303, 385–404. **Davis.**

La Pénéplaine. Par M. W. M. Davis.

Meteorology. *Rev. Scientifique* 12 (1899): 553–560. **Souleyre.**

La distribution des Pluies à la Surface de la Terre. Par M. A. Souleyre.

An attempt to explain the distribution of rainfall on the Earth's surface.

Meteorology. *Symons's Monthly Meteorolog. Mag.* 34 (1899): 129–135. ———

Meteorological Extremes.—II. Temperature.

The maximum annual range of the world is 217°·8 Fahr., formed by a maximum recorded at Wargla of 127°·4 on July 17, 1879, and a minimum of −90°·4 at Verkhoyansk on January 15, 1885.

Meteorology. ———

Die Orkane des Nordatlantischen Ozeans in der letzten Woche des Januar und den ersten Wochen des Februar 1899. Herausgegeben von der Direktion der Seewarte. Beiheft I. zu den "Annalen der Hydrographie und Maritimen Meteorologie," Heft vii. (Juli), 1899. Berlin: E. S. Mittler & Son. Size 10½ × 7½, pp. 34. *Charts.*

An account, with synoptic chart, of the remarkable series of cyclones which swept across the North Atlantic in January and February, 1899.

Meteorology. *P. American A. Arts and Sci.* 34 (1899): 599–618. **Clayton.**

Investigations on Periodicity in the Weather. By H. Helm Clayton. *With Diagrams.*

Meteorology. *J. School G.* 3 (1899): 241–250. **Ward.**

Equipment of a Meteorological Laboratory. By Robert De C. Ward.

Lists of instruments and books suitable for practical instruction in meteorology for schools.

Meteorology—Isotherms. **Meinardus.**

Die Entwickelung der Karten der Jahres—Isothermen, von Alexander von Humboldt bis auf Heinrich Wilhelm Dove. Von Wilhelm Meinardus. Sonderabdruck aus der Humboldt-Centenar-Schrift der Gesellschaft für Erdkunde zu Berlin, 1899. Size 11 × 7½, pp. 32. *Maps. Presented by the Author.*

Meteorology—Rainfall. **Herbertson.**

The Monthly Rainfall over the Land-Surface of the Globe. Inaugural-Dissertation zur erlangung der philosophischen Doktorwürde vorgelegt der Hohen philosophischen Facultät der Albert-Ludwigs-Universität zu Freiburg im Breisgau. Von Andrew John Herbertson. 1899. Size 10 × 6½, pp. 60. *Maps.*

Ocean Currents. *J. and P.R.S. New South Wales* 32 (1898): 120–131. **Hepworth.**

Current Observations on the Canadian Australian Route. By Captain M. W. Campbell Hepworth. *With Charts.*

Observations on the Pacific ocean on the route from Vancouver to Sydney, N.S.W., resulting from sixty-two passages.

Ocean Currents. *J. and P.R.S. New South Wales* 32 (1898): 230–240. **Russell.**

Current Papers, No. 3. By H. C. Russell, B.A., etc.

Oceanography. **Murray.**

Oceanography. By Sir John Murray, K.C.B., etc. From the *Geographical Journal* for October, 1899. Size 10 × 6½, pp. 16. *Chart. Also, without chart, from the British Association Report for* 1899.

Oceanography. *Ann. Hydrographie* 27 (1899): 327–335. **Schott.**

Von der deutschen Tiefsee-Expedition. Dritter Bericht des Ozeanographen der Expedition Dr. Gerhard Schott.

Physiography. *Rev. Scientifique* **12** (1899): 289–295, 364–369, 424–429. **Klossovsky.**

La vie Physique de notre Planète. Par M. A. Klossovsky. *Also a separate copy, Odessa*, 1899. *Presented by the Author.*

By the physical life of the planet M. Klossovsky means the interacting agencies which produce the circulation of air and water, the movements of the crust, and the development of the land.

Phytogeography. **Engler.**

Die Entwickelung der Pflanzen-Geographie in den letzten hundert Jahren und weitere Aufgaben derselben. Von A. Engler. In *Wissenschaftliche Beiträge zum Gedächtniss . . . Alexander von Humboldt.* Berlin: W. H. Kühl, 1899. Pp. 1–247.

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 35–45. **Riccò.**

Riassunto della sismografia del terremoto del 16 nov. 1894. Parte ii. Oggetti lanciati a distanza, volocità di propagazione, profondità dell' ipocentro, repliche, confronto col terremoto del 1783. Nota del A. Riccò.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Tomé.**

Geografia del presente e dell' avvenire ossia etnografia e geografia politica del mondo civile giusta i principii della etnicarchia. Studii e proposte di Giuseppe Tomé. 3 vols. Torino e Roma: E. Loescher, and Porto Maurizio, 1880, 1893, 1898. Size 9½ × 6½, pp. (vol. i.) 112; (vol. ii.) 168; (vol. iii.) 454. *Presented by the Author.*

The first volume is a work in two parts: the first on theoretical ethnography in relation to geography; the second, practical applications of the theory to the actual cases of the different nations of the world, explaining their present political conditions and forecasting their future. The two later volumes fill up in greater detail the general scheme of the first volume.

Commercial Geography. **Rozenraad.**

The Commercial Struggle of the Nations. By C. Rozenraad. Speech delivered at the Institute of Bankers, February 2, 1898. London: Smith & Ebbs, 1898. Size 11 × 7½, pp. 40. *Presented by the Author.*

History of Geography. **Keane.**

The Evolution of Geography. A sketch of the Rise and Progress of Geographical Knowledge from the earliest times to the first Circumnavigation of the Globe. By John Keane. London: E. Stanford, 1899. Size 8½ × 6, pp. xvi. and 160. *Maps, Portraits, and Illustrations. Price* 6*s. Presented by the Publisher.*

The aim of this book is to trace the development of geographical ideas and knowledge from their infancy. The knowledge of the early Egyptians, Hebrews, and Greeks is disposed of in a chapter of about thirty pages. Other short chapters summarize the advances in the early Christian ages, under the Crusading impulse, and a chapter each is given to Columbus and Magellan. There the history stops. Two general chapters deal with early maps and with instruments. It affords a summary of the growth of geographical knowledge suited for those for whom the works of Toxer and Vivien St. Martin, not to speak of Bunbury, are too long.

Historical—Strabo's Theories. *Riv. G. Italiana* **6** (1899): 542–553. **Cossu.**

Il concetto di Geografia presso Strabone. Nota del Dott. A. Cossu.

BIOGRAPHY.

Botella y de Hornos. *Deutsche Rundschau G.* **21** (1899): 517–520. **Levy.**

D. Federico de Botella y de Hornos. *With Portrait.*

The subject of this memoir, a distinguished Spanish geologist, has done much to advance our knowledge of the physical geography of the Iberian peninsula.

Bòttego. *Deutsche Rundschau G.* **22** (1899): 87–88. ——

Vittoria Bòttego. *With Portrait.*

Bowen. *Deutsche Rundschau G.* **21** (1899): 571. ——

Sir George Bowen. *With Portrait.*

Chun. *Deutsche Rundschau G.* **22** (1899): 37–39. **Wolkenhauer.**

Prof. Dr. Karl Chun. *With Portrait.*

Prof. Chun was the leader of the German deep-sea expedition in the *Valdivia*.

French Travellers. *B.S.G. Lyon* **18** (1899): 5–17. **Chambeyron.**

Lyon voyageur et géographe. Par E. Chambeyron.

On travellers born in Lyons.

Hartl. *Deutsche Rundschau G.* **22** (1899): 86–87. ——

Heinrich Hartl. *With Portrait.*

Colonel Hartl was appointed Professor of Geodesy in the University of Vienna in 1899.

Huth. *Deutsche Rundschau G.* **21** (1899): 373–375. ——

Dr. Georg Huth. *With Portrait.*

Dr. Huth is a prominent linguistic scholar who has paid special attention to the ethnology of Eastern Asia.

Jordan. *Deutsche Rundschau G.* **21** (1899): 520–522. ——

Prof. Dr. W. Jordan. *With Portrait.*

Prof. Jordan of Hannover—born 1842, died April 17, 1899—was a geodesist, and took part in Rohlf's exploration of the Libyan desert in 1873–74.

Marcou. *P. American A. Arts and Sci.* **34** (1899): 651–656. **Hyatt.**

Jules Marcou. By Alpheus Hyatt.

Mizon. *Deutsche Rundschau G.* **21** (1899): 471–473. ——

Louis Mizon. *With Portrait.*

M. Mizon, born in 1853 in Paris, died in 1899 at Jibuti, after having had a career as an African explorer and colonial official.

Müller. *Deutsche Rundschau G.* **21** (1899): 375–377. ——

Dr. Karl Müller. *With Portrait.*

Dr. Müller's work lay in the departments of botanical distribution and popular exposition. He was born in 1818, and died on February 9, 1899.

Pauliny. *Deutsche Rundschau G.* **22** (1899): 39–41. ——

J. J. Pauliny. *With Portrait.*

An able cartographer and instructor in the Austrian Geodetic Institute, who, amongst various other extra duties, spent several years on leave in giving cartographical instructions to the Egyptian and Japanese surveys. He was born in 1827, and died June 11, 1899.

Pickering. *Deutsche Rundschau G.* **21** (1899): 468–471. ——

Edward Charles Pickering. *With Portrait.*

E. C. Pickering was born in 1846 in Boston, and became director of the Harvard observatory in 1876.

Salm. *Deutsche Rundschau G.* **21** (1899): 568–570. ——

Fürstbischof Franz X. Altgraf Salm. *With Portrait.*

The Prince-Bishop Salm of Gurk, in Carinthia, was one of the pioneers of Austrian alpine study. He was born in 1748 or 1749, in 1799 he made the first ascent of the Gross-Glockner, and died in 1822.

Winsor. *P. American A. Arts and Sci.* **34** (1899): 641–645. **Lowell.**

Justin Winsor. By A. Lawrence Lowell.

An interesting record of the work of the late Justin Winsor as a librarian and bibliographer.

GENERAL.

Arabic Language. **Thimm.**

Arabic Self-Taught. (Syrian.) With English Phonetic Pronunciation, containing Vocabularies—Elementary Grammar, Idiomatic Phrases and Dialogues—Travel Talk—English and Arabic Dictionary. By C. A. Thimm. Edited by A. Hassam and Prof. G. Hagopian. Third Edition. (Revised and corrected.) London: E. Marlborough & Co., 1899. Size 7½ × 5, pp. 96. *Price* 2*s.* 6*d.* *Presented by the Publishers.*

Bibliography—Subject Index. ——

Minutes of Proceedings of the Institution of Civil Engineers. Subject-Index, vols. cxix. to cxxxviii., Sessions 1894–95 to 1898–99. Size 8½ × 5½, pp. 88. *Presented by the Institution of Civil Engineers.*

British Empire. **Woodward.**

A Short History of the Expansion of the British Empire, 1500–1870. By William Harrison Woodward. Cambridge: the University Press, 1899. Size 7½ × 5, pp. x. and 326. *Maps. Presented by the Cambridge University Press.*

A very compact and logically arranged history of the acquisition and growth towards a complete system of government, of the various possessions which were under the British flag before 1870.

Educational—Methods. **Reynolds.**

The Teaching of Geography in Switzerland and North Italy, being the Report presented to the Court of the University of Wales on a Visit to Switzerland and North Italy in 1898, as Gilchrist Travelling Student. By Joan Berenice Reynolds, B.A. London: C. J. Clay & Sons, 1899. Size 7½ × 5, pp. xii. and 112. *Presented by the Publishers.*

Describes the methods of teaching geography in elementary and higher classes in different parts of Switzerland and in a few towns in the south of Italy.

French Colonies. **Gaffarel.**

Les Colonies Françaises. Par Paul Gaffarel. Sixième édition. Paris: F. Alcan, 1899. Size 9 × 6, pp. 564. *Price 5 fr.*

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XVII. 11. **Glamorganshire,** X. 4, 11, 12; XI. 1; XVII. 8; XXVII. 5, 13; XXXV. 7, 8, 10, 11, 12, 13, 16; XLI. 2, 4, 5, 6, 9, 10, 11, 12, 13, 14. **Nottinghamshire,** IX. 2, 3, 4, 9, 12, 16; XIV. 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XIX. 1, 5, 6, 8. **Oxfordshire,** XIX. 16; XXVI. 1, 3, 4; XXVIII. 12; XXXIII. 14; XLV. 6. **Staffordshire,** VI. 8, 16; X. 7, 12; XI. 8, 12; XII. 5, 15, 16; XIII. 13, 16; XIV. 4, 13; XVI. 4; XVII. 2, 5, 6, 7, 8, 10. **Westmorland,** III. 12. **Wiltshire,** XVII. 13; XXIV. 6, 10. *3s. each.*
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Gallia. **Grundy.**

Murray's Handy Classical Maps: Gallia. Scale 1: 2,500,000 or 39·7 stat. miles to an inch. Edited by G. B. Grundy, M.A., of Brasenose College, Oxford. London: John Murray, 1899. *Price* 1*s. With Index. Presented by the Publisher.*

This is the first issue of a series of handy classical maps in course of publication by Mr. Murray. It is orographically coloured in three tints, showing elevations from sea-level to 600 feet, from 600 feet to 3000 feet, and elevations above 3000 feet; the boundaries of countries and provinces being shown by red lines. Two insets are given, one of Gallia at the time of Cæsar, and the other of Insula Batavorum. The map, which is furnished with an index, has been edited by Mr. G. B. Grundy, M.A., and produced by Bartholomew in his usual clear style. As the maps of this series can be purchased separately, they will be most useful to students or persons attending lectures.

ASIA.

China. **Chevalier.**

Atlas du Haut Yang-Tse de I-Tchang Fou à P'ing-Chan Hien par le R. P. S. Chevalier, S.J. 1^er^ Fascicule de I-Tchang Fou à Tchong-King Fou. Observatoire de Zi-Ka-Wei. Shanghai, 1899.

This is the first issue of an Atlas of the Upper Yang-tse; it contains thirty-nine sheets, and includes the river between Ichang and Chung-King. Soundings are in metres at the time when the water is lowest, and the lettering is given in Chinese, French, and English. When completed the atlas will contain a survey of the source of the Yang-tse from I-chang to Ping-shan. The atlas is accompanied by explanatory letterpress.

AFRICA.

Transvaal. **Mackenzie.**

New Relief Map of the Transvaal. Scale 1: 1,000,000 or 15·8 stat. miles to an inch. By E. A. Mackenzie. The Universal Publishing Co., Ltd., London, 1899. *Presented by the Publishers.*

West Africa. **Diderrich.**

Carte de la Région du Mayumbe du Congo au Chiloango, dressée par l'Ingénieur N. Diderrich, Directeur Général de la Société des Chemins de Fer Vicinaux du Mayumbe. Scale 1: 125,000 or 2 stat. miles to an inch. Librairie Falk Fils, Bruxelles, 1899. 4 sheets.

This map has apparently been published to show existing and proposed lines of railway in the Mayumbe district of French Congo. It has been drawn on a large scale to show the results of preliminary surveys, and contains but little other information.

POLAR REGIONS.

South Polar Regions. **Lecointe.**

Expédition Antarctique Belge. Commandée par le Capitaine A. de Gerlache. Croquis provisoire du Détroit de la Belgica, dressé par le Lieutenant de Vaisseau G. Lecointe, Commandant en second de l'expédition. Scale 1: 400,000 or 6·3 stat. miles to an inch. Société Royale Belge de Géographie, 1899.

GENERAL.

French Colonial Atlas. **Mager.**

Nouvel Atlas Colonial, par Henri Mager, Membre du Conseil supérieur des Colonies (1892–97), Conseiller du Commerce extérieur. Vingtième mille. Paris: Ernest Flammarion, Éditeur. *Price* 1·5 *fr. Presented by the Author.*

World. **Meyer.**

Meyer's Hand-atlas. Zweite, neubearbeitete und vermehrte Auflage mit 112 Kartenblättern, 9 Textbeilagen und Register aller auf den Karten verzeichneten

Namen. Parts 31 and 32 (in one), 33 and 34 (in one), and 35 and 36 (in one). Leipzig und Wien. Verlag des Bibliographischen Instituts, 1899. *Price 60 pf. each issue.*

World. **Vivien de Saint Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Paris: Librarie Hachette et Cie. Sheet: Italie Septentrionale. *Price 2 fr.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, September and October, 1899. *Presented by the Hydrographic Department, Admiralty.*

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(*J. D. Potter, Agent.*)

Scotland. **Hydrographic Office.**

Tidal Streams round the Coast of Scotland. Hydrographic Office, London. 1899. 12 charts. *Price 5s. Presented by the Hydrographic Office.*

The twelve charts which this atlas contains show the direction and rate in knots of the tidal streams round the coasts of Scotland for every hour of the tide at Dover. They have been compiled from observations made during the various Admiralty surveys from 1836 to 1899, and from observations made at the lightships of the Northern Lights Commissioners.

The compilation of these charts has been carried out by Commander Courtland H. Simpson, R.N.

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic and North Pacific Oceans for November, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Central Asia. **Rickmers.**

Twenty Photographs of Russian Turkestan, Bokhara, etc., by W. R. Rickmers, Esq. *Presented by W. R. Rickmers, Esq.*

These photographs were taken by Mr. W. R. Rickmers in Russian Turkestan and Bokhara. The following is a list of their titles:—

(1) Looking east from the top of Hazrat-Ishan; (2) Yakh-Su valley, looking up from mouth of Safet-Daria; (3) Hissar; (4) Conglomerate; (5) Looking south from the interior of the double barrier; (6) Hazrat-Ishan, from a point on the west ridge; (7) In the Beg's garden, Baljnan; (8) Right bank of the Safet-Daria just above its mouth; (9) Left bank of the Safet-Daria opposite the Russian colony (barrier V.); (10) The Russian colony (November); (11) Baljnan; (12) Conglomerate scenery; (13) General view of conglomerate ranges; (14) A side valley of the Yakh-Su; (15) Hazrat-Ishan and the Safet-Daria valley; (16) A bridge, Karatagh; (17) Gallows; (18) A court-yard; (19) A gorge, Dandushka; (20) Village near Munninabad.

China. **Watson.**

Forty Photographs of the Upper Yang-tse Kiang. By Lieut. H. D. R. Watson, R.N., of H.M.S. *Woodcock*. 1899. *Presented by Lieut. H. D. R. Watson, R.N.*

This interesting series of views was taken by Lieut. H. D. R. Watson, R.N., and, as their titles will show, represent river scenery of the Yang-tse above Ichang:—

(1) Win rapid; (2, 3) Ta Tong rapid; (4) Kong Sing rapid; (5-7) River opposite town of Kwei Chau, province of Hupeh; (8-10) Yeh rapid; (11) The Tao Tai of Chung King landing at Kwei Fu, province of Su Chuan; (12-13) Nin Kon rapid; (14) Looking up river just above Nin Kon rapid; (15) Wushan gorge; (16) Pagoda of Patung, province of Hupeh; (17) Wushan gorge; (18) Town of Kwei Fu, province of Su Chuan; (19) Feng Hsiang gorge, upper end; (20-23) Miao Chi Tre rapid; (24-27) Hsin Tung rapid, or new rapid of Yun Yang Hsien; (28, 29) New rapid; (30, 31) River and river-bed in May, 1899, 4 miles above Yun Yang Hsien; (32-36) Hsin rapid; (37-40) Nin Kon rapid.

South America. **Wallace.**

Forty-nine Photographs taken during a Journey from Salta (Argentine Republic) to La Paz (Bolivia), by L. A. Wallace, Esq. *Presented by L. A. Wallace, Esq.*

The journey which these photographs illustrate was undertaken by Mr. L. A. Wallace in 1893. The series consist of forty-nine photographs, of which the following are the titles:—

(1, 2) Looking up stream (Rio Grande) near Senequillas, about 70 miles north of Jujuy, Argentine Republic; (3, 4) Humahuaca; (5, 6) On road in river a few miles north of Humahuaca; (7) Summit above Ojo de Aquas; (8) At the Posta Cangrejillos; (9) Mojo church; (10) Mojo in distance; (11) In village of Naserino; (12, 13) On road in river above Naserino; (14) General view of Tupiza, Bolivia; (15) Cuesta de Almona; (16, 17) Cultivating fields at Totora, a little beyond Almona; (18, 19) Town of Cotagaita, Bolivia; (20, 21) Indians near Cotagaita; (22, 23) Arrival of mules at the Posta of Lagunillas, Bolivia; (24, 25) The Posta at Tolapalca, Bolivia; (26) Posta at Anacato; (27-29) Indians dancing in Posta of Challapata, south end of Lake Aullagas (Poopoo), Bolivia, 12,500 feet; (30) Plaza in Challapata; (31) Posta in Challapata; (32, 33) Posta Machamarca, between Lake Aullagas and Oruru, Bolivia; (34-42), Taken on river Ubiquera, between Salta and Cerro Nevado, Argentine Republic; (43-49) Taken in the streets of La Paz.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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